Intentions to Use Location-Based Services: Refining a Predictive Model and Understanding Contexts of Use

LISA THOMAS

PhD

2011

Intentions to Use Location-Based Services: Refining a Predictive Model and Understanding Contexts of Use

LISA THOMAS

A thesis submitted in partial fulfilment of the
requirements of Northumbria University
for the degree of Doctor of Philosophy

Research undertaken in the
School of Life Sciences
and in collaboration with
TrackaPhone Ltd.

October 2011

Abstract

This thesis is concerned with the processes involved in the perception, adoption and use of location-based services (LBS). Location-based services are able to pinpoint the geographical position of an individual and are most often deployed on mobile devices. The capability for LBS to be integrated into other systems such as social networking sites is also growing.

The focus of current LBS research is on the development of security measures to protect privacy. The actual privacy concerns of real LBS users, however, have not been considered. The work in this thesis examines location-based services from a *user* perspective. A previously untested predictive model of LBS was assessed, and shown to be unsuited to account for intentions to use the technology in a workplace setting. A revised and improved model is proposed that suggests four factors account for intentions: perceived usefulness, trust of the LBS provider, disclosure to employer and trust of the employer.

This research investigated the types of location information that might be disclosed when using LBS, who the recipients might be, and how people categorise location information into meaningful clusters. Results showed that people have explicit LBS preferences, with the receiver of information and context playing a large role in determining disclosure.

Three qualitative case studies aimed to understand implications of LBS use with different populations. Participants raised concerns about trustworthiness of their employer and knowledge of LBS providers, providing support for the theoretical model. These case studies suggest LBS could also successfully be applied to alternate user groups.

These findings have important implications for LBS providers and industry. People have a desire to know who the LBS provider is and what role they will play. Making these issues explicit should improve trust and develop the user-LBS provider relationship. When implementing LBS in the workplace, consultation with employees and providing clear information may enhance trust of the employer.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Acknowledgements

Without funding from the ESRC, and support from Trackaphone, this work would not have been possible. I would also like to thank my supervisors, Pam Briggs and Linda Little, for their continued advice, support and good humour. Special thanks go to Lynne Coventry for her proof reading skills, and Paul Agnew for his administrative support.

Thanks to everyone from CoCo and PaCT, past and present, for being great colleagues and friends. In particular I would like to thank Jenny, my mentor, for helping me settle into the department, and Libby for her continued support, friendship, and statistics coaching.

Finally, I hope this work is an enjoyable read for my examiners Lynn McInnes and Steve Love.

Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought and granted by the School Ethics Committee for each study.

Name:

Signature:

Date:

THESIS OVERVIEW

This thesis focuses on location-based services (LBS) using various methods in order to understand adoption, context of use and individual's attitudes towards location-based services. The first three chapters incorporate a review of the literature relating to current understanding of LBS: Chapter 1 describes what location-based services are, the concerns surrounding this technology, and the rationale for this research; Chapter 2 identifies privacy and disclosure issues relating to the use of location-based services; Chapter 3 describes the various research approaches that have been used to assess location-based services, and highlights where further research is required.

There are two main research questions which will be addressed in this thesis:

1. *What predicts LBS use, and what role does privacy and disclosure play?*
2. *What different contexts affect attitudes towards LBS use?*

The first research question will be addressed in chapters 4-6. Chapter 4 identifies a theoretical model suggested to predict intentions to use LBS, and tests this model using a questionnaire study. This model has not been validated, but is one of the most complete to account for LBS use. The testing of this model fills a clear gap in the LBS literature. Chapter 5 reviews the theoretical model, identifies modifications, and re-tests a new model using a revised questionnaire. Chapter 6 explores the implications of disclosure preferences, looking at types of location information, and how this information may be disclosed to different people. Research has suggested that disclosure via technology differs depending on the type of information being disclosed and the receiver of that information. There is limited knowledge about disclosure of location information in an LBS context.

The second research question will be addressed in chapters 7-9, with the use of case-study examples. Chapter 7 describes an interview conducted with a lone-worker, who had experience of using LBS in the workplace. Whilst workplace use is one of the main applications for LBS technology, detailed research exploring employee perceptions is lacking. Chapter 8 focuses on a group of older adults who had experience of using LBS as part of a previous trial. However, this trial was never assessed in terms of user satisfaction and perceptions of the technology from the older adult perspective. Chapter 9 describes the experiences of a family with a behaviour disordered son who used LBS; a novel application of the technology, and an opportunity to understand if and how LBS would impact a family user group. These case studies suggest different contexts that LBS may be applied to, and more importantly, are an example of the way qualitative research can enhance our understanding of LBS use with different populations. Chapter 10 will summarise the answers to these research questions, and discuss implications for industry.

CHAPTER 1: LOCATION-BASED SERVICES

Location-Based Services (LBS) have been defined as 'services that take into account the geographic position of an entity' (Junglas, 2007, p. 391). Pin-pointing a geographic position can be achieved in a number of ways, with many mobile phones including applications which enable people to share their location. In the UK, LBS can use a base station to determine a phone's location. Newer phones now utilise Global Positioning Systems (GPS). The applications for LBS are growing rapidly, yet despite its capabilities real-world research into LBS implementation and the perspectives of users have so far been limited. Nevertheless, when research *has* explored LBS use, the technology is often perceived as a threat to privacy. This fundamental privacy issue has caused growing concern due to the instant and detailed capabilities of LBS to pinpoint a user's whereabouts in real time. In subsequent chapters these privacy issues will be addressed, however, this chapter will outline what LBS are, how they can be used, and why research into this area is warranted.

1.1 Why study LBS?

There has been a huge growth in the LBS industry, and the emergence of LBS technology in more mainstream settings has caused people to take notice and question its unobtrusive nature (Bettini, Jajodia, Samarati, & Wang, 2009). As LBS have started to permeate much of our lives, so has the controversy surrounding them. News reports suggest that law enforcement agencies in the US have been exploiting an unpublished location tracking capability of iPads and iPhones to aid in criminal investigations (McCullagh, 2011). In a case to convict a suspected murderer, a US

court used cell phone records to prove that their suspect was not in the location he claimed to be on the day of the murder (Barnard, 2009).

The uncertainty regarding laws about the use of LBS has caused them to be a major legal consideration and of great public importance. In Australia police have the power to fit people suspected of terrorist activities with tracking devices (Perusco & Michael, 2007), and early release schemes for prisoners fitted with a monitoring tag have been a contentious aspect of the UK justice system (BBC, 2001). These unanticipated applications of LBS technology reveal that it is not only limited to use between friends or the employer and employee, but is relevant for broader sections of society. The value of LBS has also been considered by employers, in terms of their legal obligations to their employees. Many LBS providers are using Health & Safety regulations to encourage employers to initiate LBS use, often with lone-worker safety as a major driving force (Romex, 2009). However, these commercial businesses are not primarily concerned with research into the perceptions of their LBS product.

There have been some academic assessments of LBS, and research has explored the usability of prototype systems. The Massachusetts Institute of Technology (MIT) developed an LBS prototype called 'Safe and Sound' (Marmasse & Schmandt, 2003), which used location-aware technologies to establish child safety. The child is given a mobile phone to carry, and if they move out of an agreed area, both parent and child receive an alarm warning. A similar concept of 'safe areas' has been used when testing LBS equipment with dementia patients in residential care homes (Miskelly, 2004). Their study used wristbands to 'tag' residents at a care home, with the aim of reducing patient wandering. The system recognised all occurrences of

wandering, and staff as well as relatives reported feelings of reassurance. Some research is beginning to address issues surrounding the involvement of real users, however there is still a lot more that needs to be done.

1.2 The development of LBS

Location-based services first entered public consciousness when the Enhanced-911 (E911) mandate became operational in the US in 1996. The US Federal Communications Commission (FCC) issued the E911 mandate, which was created to provide emergency services with a caller's location when they dialled 911. The accuracy of the LBS system was between 50 and 300 meters. The ability to accurately and quickly locate emergency calls was, and still is, of value to the emergency services. In the UK, a similar 'E-112' directive was issued which meant that phone operators were required 'to make caller location information available to authorities handling emergencies, to the extent technically feasible, for all calls' (Liikanen, 2003, p. 49). Research has shown that the emergency service responses have been improved by people using location-aware phones (Minch, 2004).

Until 2005 however, LBS were not utilised commercially and usually consisted of basic services such as the tracking of vehicles. For instance, United Parcel Service (UPS) implemented *Quantum View Inbound*, a tracking system to notify customers a parcel was nearing their location for delivery. This was designed to improve delivery speed and accuracy. Wal-Mart stores also worked with its suppliers to deploy RFID tags to track crates and pallets in its supply chain (Vijavan & Brewin, 2003). However, privacy issues were emerging even with the use of these basic services,

with consumers being worried that their purchases could be tracked and linked to their personal information (Jonietz, 2004).

There were attempts to utilise greater LBS capabilities when the E911 directive was launched, however these services mainly focused on *location-aware* methods, and were not commercially favourable. Location-aware services allow the user to request useful information about their current location, for example, requesting local restaurant information. The later development of global positioning systems (GPS) and 3G technology enabled a broader range of LBS services to become available, and ultimately allowed users to exchange their location information (Bellavista, Kupper, & Helal, 2008).

There are now numerous location-based technologies available, all with varying accuracy, coverage ability, set-up procedures and costs (Hazas, Scott, & Krumm, 2004). Despite the majority of systems working outdoors, with accuracy of around ten meters, systems have also been developed to enable indoor locating-tracking (Priyantha, 2005). However, accurate indoor tracking is limited in comparison to the widely established outdoor positioning technologies (Papataxiarhis et al., 2009). Due to the greater number of outdoor LBS systems, and their dominance in previous research, they will be the focus of this research. The different types of outdoor LBS applications will be discussed in turn.

1.3 Current LBS Applications

Researchers have identified four main applications for LBS use: '*Where am I?' queries*, *Point of Need Information Delivery*, *Niche Consumer Applications* and *Corporate Applications* (Rao & Minakakis, 2003).

1.3.1 Where am I?

These queries enable the user to locate where they are, and to alert friends, family and colleagues to their location. There are a growing number of LBS systems which have been designed to encourage communication and friendship, focusing on the immediate connection that they provide between users. For example, in 2002 the US company AT&T Wireless launched a 'Find Friends' service which allowed users to locate friends and family members using GPS on their mobile phones (Lawson, 2002). This service may not necessarily be visible when you purchase a phone, however, and concerns were raised over whether users would be aware it was enabled, or how they could turn it off. These kinds of LBS systems do not necessarily offer greater privacy assurances.

Services such as *Foursquare*, *Facebook Places* and *Gowalla* have recently emerged as a way that people can locate each other using LBS (Sullivan, 2010). Many of these applications are designed for mobile phone use, which enable the user to be located on the move.

Foursquare encourages users to add friends from other social networking sites, to 'check in' to a place or event, and even rewards frequent users with status badges (Figure 1.1). *Facebook Places* also enables the user to check in to a place, which sends their location information to their 'news feed' so friends and family can view it. This social networking application also allows one person to 'tag' a friend into the same location with them, providing their privacy settings haven't been modified.

Figure 1.1 Badge rewards for frequent Foursquare users

Gowalla focuses more generically on travel, for which you create a virtual passport (indicating locations you have been to), connect with friends via Facebook and Twitter (again sharing location), and 'pin' photos of trips to your profile. Another US-based service called Loopt integrates LBS functions with social networking aspects, enabling the sharing of location status as well as messages and photos (Reardon, 2006). These kinds of systems are revealing that LBS are becoming popular, quickly adopted, and integrated into systems such as social networking sites that are already widely used. Importantly, the incentives to use these kinds of services are emphasised to users in a competitive manner. However, the amount of privacy a user has control over is not as publicised.

1.3.2 Point of Need Information Delivery

Point of need information involves location-aware technology, which provides information to users which is relevant to their location. This may include information about new products, services and promotions compiled using a more advanced knowledge of the user. For example, a visitor to an unknown city may use location aware services to discover where the nearest tourist information office is. This service is often used to offer coupons or e-vouchers for nearby restaurants, cinemas or bars. Facebook Places has started to provide users with discounts at retailers, eateries and entertainment venues if they check in. In 2010, the North Face® outdoor clothing company implemented a system whereby shopping deals can be sent via text message to customers on their mobile phone when they near their stores.

This method of locating services requires constant communication with the service provider to determine nearby amenities. Researchers assessing location-aware scenarios with real users have found an overall positive response to these services, particularly when people are in an unfamiliar environment and need information. However, services providing shopping information have not been received as positively (Kaasinen, 2003).

1.3.3 Niche Consumer Applications

Researchers have suggested that niche consumer LBS applications may include services such as golfing assistants and fish finders, mostly appealing to sports enthusiasts (Rao & Minakakis, 2003). However, far from being a niche product, LBS are being used by more people and their use is becoming increasingly incorporated

into everyday life. The integration of LBS into Facebook is one example of the way this technology is becoming more universally accessible.

However many LBS have been designed with niche groups in mind. LBS providers have, for example, appealed to people with a responsibility to look after vulnerable people. The LoJack SafetyNet® system is an LBS application currently available in the US. This tracking device is said to be specifically designed for caregivers and family members of anyone with a medical condition which may cause them to wander (LoJack, 2011). This system consists of a basic strap worn around the wrist, boasting of 'proven technology', 'consistent frequent coverage' and is said to offer 'peace of mind' to the user. This system is also linked to US law enforcement agencies, so if the wearer of the strap becomes lost, search and rescue teams can assist in finding them. Similarly, the UK-designed *Buddi* is marketed as a system that can eliminate worry and help the user feel confident about the whereabouts of a loved one (Buddi, 2007). The focus on vulnerable people is promoted on their website:

"Many of the people we care about most can be vulnerable – elderly parents or relatives, individuals with Alzheimer's and dementia, children, teenagers and those with learning difficulties. We all know someone who could benefit from a Buddi".

1.3.4 Corporate Applications

Corporate and business customers may utilise LBS services by the tracking of products or staff. There has been a steady emergence of service providers offering LBS tailored specifically to tracking employees (Charny, 2004). These applications are often promoted with the safety of the employee as a major reason for adoption.

More recently, the idea of a duty of care has emerged, with employers being more accountable for their staff, regardless of whether they work in an office or on a building site. The realisation that workers could soon be regularly monitored by their employers has caused concern, with some employers explicitly reporting they will use the technology to assess employee performance (BBC News, 2010).

1.4 LBS providers

In order for LBS to be accessed, there needs to be engagement with an LBS provider. The provider will usually liaise with national mobile phone companies to provide a particular service, and can offer a complete LBS package to accommodate user needs. This practice reduces implementation costs, as well as allowing the user to choose any device on which to use LBS software. In the UK alone, companies such as AST distribution, Active Web Solutions, Track24, Wireless Innovation and Rock Seven all provide LBS. These companies offer numerous products designed to provide tracking solutions.

1.4.1 Trackaphone

TrackaPhone is an independent North-East LBS provider who offer location based applications through a variety of platforms and devices (TrackaPhone, 2011). This thesis has been developed in collaboration with Trackaphone. Their clients include city councils, regional police forces, sports clubs, security firms, transport companies, and they have also been industry collaborators on a number of projects at Northumbria University. One of their services, People Locator, is an internet-based system which highlights an individual's location on a map (Figure 1.2). The dots on the map denote a person's location movements, while the text-box below lists times,

addresses and co-ordinates for those locations. This kind of system is marketed to various user groups, but 'employee protection' is one of the major uses for this kind of technology.

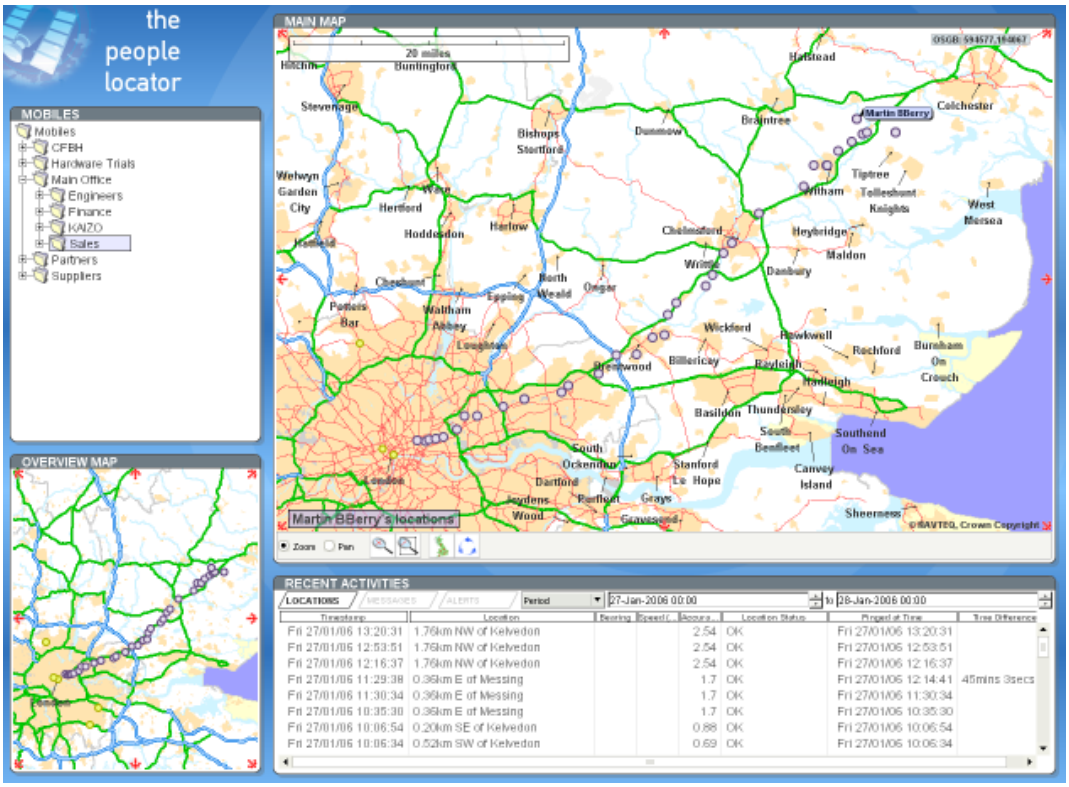


Figure 1.2 People Locator map

Trackaphone have a system in place to ensure there is a service agreement between the user of a device and the requester of their information. Often the user of the LBS system is able to turn it on and off via a text message sent from their device. These capabilities are in line with research which suggests that users of LBS should retain as much control as possible (e.g. Rodden, Friday, Muller, & Dix, 2002). Concerns over privacy and information control have led researchers to develop LBS systems which are more ethical for the users. For example, CleverTracker was developed to allow the user to view their recorded location data, as well as enabling them to 'opt

out' of the system altogether (Ignatova & Brinkman, 2007). The relationship between the user and LBS provider will be explored in detail in both the qualitative and quantitative studies throughout this thesis. As this research was funded by the ESRC via a CASE studentship award, the focus of this thesis has been to engage with, and conduct research which is of value to both industry and academia.

1.5 LBS concerns

When LBS technology emerged, many researchers and social commentators described it as a potentially 'killer app'. However, in terms of LBS use in the workplace, this uptake has certainly not been as great as expected. It could be argued that the potential for information loss, or the public's growing appreciation of privacy has slowed the success of LBS. However, alternative use of LBS within social networking sites suggests it is being used in different contexts. In 2005, entering the term 'location-based services' into Google retrieved 48,200 documents (Jiang & Zipf, 2006). A search in 2011 revealed there are approximately 160,000,000 results. Whilst LBS are becoming more familiar in some contexts, psychological research into its uses has been lacking.

Looking at the growing number of LBS applications, a major consideration for this area has been privacy. Questions have been asked about the potential uses of LBS such as 'Do the police have the right to locate someone suspected of an illegal activity?', or 'Does a mentally ill patient need their carer to have their GPS information?' (Michael, McNamee, & Michael, 2006). The way people perceive LBS will have a significant influence on their attitude towards it. A lot of the LBS literature, as well as media reports of technology's ubiquitous permeation of society,

present the technology in a negative light. The mere act of collecting location data is not necessarily harmful, but it may be *perceived* as 'menacing' (Lianos, 2003). Negative public perceptions of data collection and storage has not been improved with recent reports of security breaches and data loss (Harrison, 2008). It has also been argued that in order to alleviate privacy concerns, LBS technology needs to incorporate better encryption software and more secure networks, as well as providers engaging in improved communication with customers (Rao & Minakakis, 2003).

In spite of the negative feelings the public may have towards LBS, or at least data collection, researchers have noted that the idea of people being monitored against their will is being called into question (Essén, 2008). These negative assumptions of perception have yet to be established with rigorous scientific testing. Often the idea of an 'erosion of privacy' features in the LBS literature, yet research rarely focuses on the perceptions of the end-users of these technologies.

1.6 Chapter summary

This chapter has described the origins of LBS, from the first E911 mandate in the US, to the global development of GPS technology today which has incorporated LBS capabilities into mobile devices. LBS applications have been summarised, as well as the way they have been categorised in terms of function. The ways in which LBS are distributed by means of LBS providers has been described, with a particular focus on the services of the industry research partner Trackaphone. The concerns regarding LBS in terms of privacy have also been introduced. It has been suggested that privacy may be 'the greatest barrier to the long-term success of ubiquitous

computing' (Hong, Ng, Lederer, & Landay, 2004), and the most significant ethical issue facing GPS tracking (Michael, et al., 2006). We need to understand if users really do have privacy concerns, what can be done to alleviate them, and subsequently encourage LBS use. The issues surrounding privacy and disclosure will be discussed in more detail in the following chapter.

CHAPTER 2: PRIVACY AND DISCLOSURE

As evidenced in Chapter 1, location-based services are becoming incorporated into our routines and social practises. However, as technology has developed which can locate us anywhere, so have concerns about privacy. These privacy concerns may explain differing attitudes towards LBS technology, or even account for a lack of adoption. In this chapter privacy relating to LBS will be explored, as well as disclosure issues which are specific to LBS use. The ways in which LBS can be designed to offer more privacy control are also discussed.

2.1 Privacy as a concern

The phrase '*Big Brother'* and its Orwellian connotations have become synonymous with privacy and technology research (Hong, et al., 2004; Marias, Kazatzopoulos, Delakouridis, & Georgiadis, 2006; Monmonier, 2006). The phrase comes from George Orwell's novel *1984*, which became famous for its portrayal of surveillance and a government's encroachment on the rights of the individual (Orwell, 1949). These sentiments are considered relevant to location-tracking technologies, as they have the capability to locate a person anywhere. The similarities to Big Brother have arisen because of concerns that LBS acceptance may also mean acceptance that our location information could be accessed by anyone. Some have remarked that a reduction in privacy may cause concern for 'cheating spouses, malingering employees, and politicians who frequent strip clubs' (Monmonier, 2006, p. 89).

However, perhaps unwittingly, people are already engaged in voluntary surveillance when they access new technologies such as Instant Messenger, shared Outlook calendars, and websites such as Facebook, Foursquare and Twitter. Research has

shown that social networking sites are becoming more popular than business and media sites, and are also being used to disclose more personal information such as website addresses, phone numbers, and home addresses (Schrammel, Koffel, & Tscheligi, 2009). This suggests that people are unlikely to shun particular online services because of privacy concerns. One issue with increased technology use is that users may not fully comprehend the inherent privacy risks. For example, despite people reporting that they engage in behaviour such as reading privacy policies online, actual measures of these behaviours suggest they do not do so (Jensen & Potts, 2004). In contrast to this, more recent anger over Facebook 'spying' activities and concern for privacy invasions has led university students to develop decentralised software to enable communication between friends without the compromise of an external manager (Dwyer, 2010).

It has been suggested that in order to fully understand user privacy issues we need to determine what the user of the technology deems 'as private, from whom, and in which context' (Adams, 2000, p. 25). Concerns about privacy and technology are embedded in social and cultural contexts, therefore there is a need for research to explore privacy not just from a technical perspective, but a social one also (Dourish & Anderson, 2006).

2.2 What is privacy?

There have been two very influential Western theories of privacy, developed by Westin (1967) and Altman (1975).

2.2.1 Westin's Approach to Privacy

Privacy has been explained as a function of daily life which is there to help us adjust emotionally to situations (Westin, 1967). We are said to be able to control our levels of privacy, but can also have too little, sufficient or too much privacy in certain situations. Westin describes four *states* of privacy:

1. **Solitude**- being free from observation by others.
2. **Intimacy**- small group seclusion for members to achieve a close relationship.
3. **Anonymity**- freedom from identification and surveillance.
4. **Reserve**- a desire to limit disclosure to others.

These 4 states are said to be constantly changing, with people attempting to balance the desire for privacy with the desire for disclosure. Westin also posits four *functions* of privacy:

1. **Personal autonomy**- the desire to avoid being manipulated or exposed.
2. **Emotional release**- privacy provides the release from tensions of social life.
3. **Self-evaluation**- integrating experience into meaningful patterns.
4. **Limited and protected communication**- privacy sets interpersonal boundaries, and allows sharing of information with trusted others.

These categorisations suggest that privacy is needed in order to satisfy our needs, and we control it depending on whether we desire seclusion or intimacy. Since Westin developed his theory, numerous researchers have built on these classifications to create their own privacy structures (Margulis, 2003). The model by Westin is still considered useful today, and a '*types of privacy* × *privacy functions'* framework has been validated and extended by other researchers (e.g. Pedersen, 1999). Designing a

grid-like framework, Pederson suggested that there is a unique pattern of privacy needs met by each type of privacy, and type/function classifications could account for numerous privacy preferences (Figure 2.1).

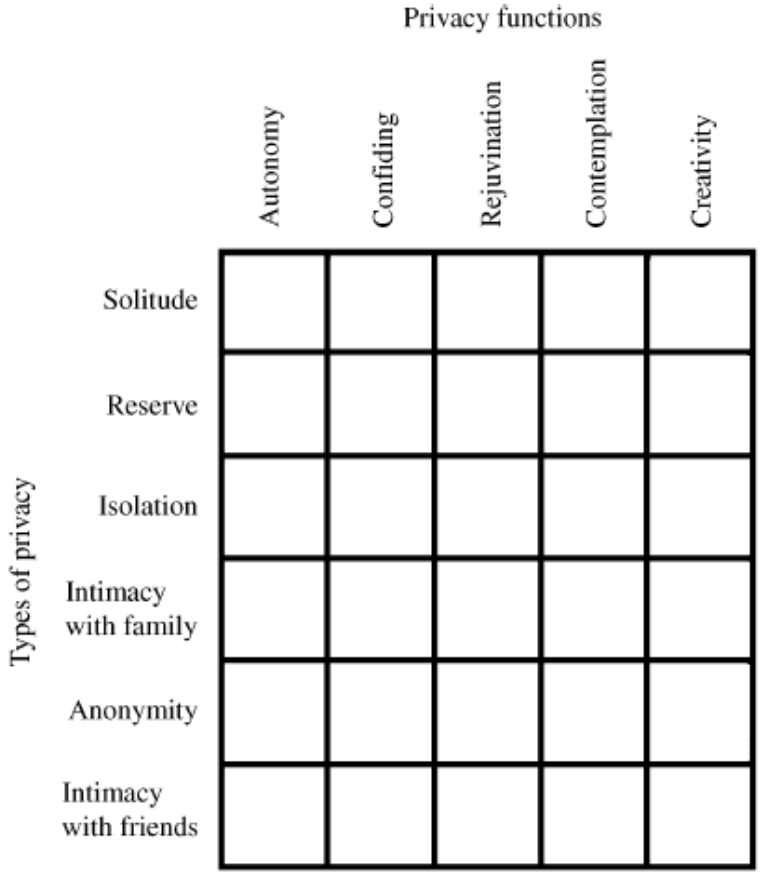


Figure 2.1 Privacy type x function (Pederson, 1999)

In 1991 Westin devised the *privacy segmentation model*, which aimed to identify individual differences in types of privacy concern (Cranor, Reagle, & Ackerman, 1999). He distinguished between three categories; *fundamentalists*, *pragmatists* and *unconcerned*. Fundamentalists are characterised as having high privacy concerns. Pragmatists are said to have more of a balanced view of privacy, and are willing to consider benefits and acknowledge costs of sharing personal information. The

unconcerned are suggested to have no worries about privacy issues (Consolvo et al., 2005). These categories have been observed in surveys exploring online privacy preferences, suggesting that the categories or privacy types apply to current technology concerns (Ackerman, Cranor, & Reagle, 1999).

2.2.2 Altman's Privacy Regulation Theory

Privacy has also been described as 'an interpersonal boundary-control process, which paces and regulates interaction with others [...] Sometimes the person or group is receptive to outside inputs, and sometimes the person or group closes off contact with the outside environment' (Altman, 1975, p. 10). This description taps into the traditional concept of privacy, which varies between different cultures, social groups and physical environments. Altman's definition also suggests that privacy is something that can be controlled by the individual. This control is described as social in nature, and functions with the interplay of other people, the physical environment, and is temporal in nature. Regulation depends on levels of 'openness' and 'closedness' of the individual. This is described in terms of a boundary-regulation process, with the individual deciding who to be in contact with, how much contact to have, and what type of contact they will share.

2.3 Privacy today

Altman and Westin were primarily concerned with face to face interactions when they devised their privacy theories, and assumed the individual was in control of the level of privacy they experienced. However, these assumptions need to be reconsidered when thinking about an increasingly networked world. Altman's ideas were grounded in the physical world; they do not apply to technology today (Palen &

Dourish, 2003). Their theoretical models of privacy suggest that it is something which can be controlled by the individual, but with the advent of LBS technology, people may not anticipate or understand the level of privacy control they have.

When communicating online, for example, the social cues we rely on to regulate privacy preferences may change or even be removed, creating 'numerous possible consequences from our computer–mediated interactions' (Palen & Dourish, 2003, p. 130). Privacy issues have changed with the emergence of new technologies, and notions of privacy have become more complex due to the different contexts in which technology is used.

2.3.1 Privacy and technology research

There is a large amount of research exploring technology use and privacy issues. Some of these issues will be discussed below, before moving on to disclosure research, and then more specifically research involving LBS usage.

2.3.1.1 Information collection

The type of information that is gathered when people use technology may be extremely important. Research has often explored information gathering online, and one study in particular found that in situations where personal information was collected, people felt uncomfortable divulging financial details, such as credit card numbers. However, people *were* willing to divulge more mundane information such as their favourite TV programmes (Ackerman, et al., 1999). Other important factors included whether information was used in an identifiable way, and the purpose for which the information was collected.

However, the suggestion that people will not disclose sensitive information is under debate. Studies have shown that users can forget about privacy concerns when actually engaging with technology (e.g. Berendt, Günther, & Spiekermann, 2005). A number of researchers discuss the idea of economy, or a cost benefit trade-off (e.g. Dourish & Anderson, 2006). For example, people may often feel that the convenience of being able to pay for shopping on a credit card outweigh any concerns about their purchase history being collected by a credit card company. Research has confirmed that consumers are willing to disclose information to companies in exchange for benefits such as fewer mobile phone interruptions (Khalil & Connelly, 2006). Some privacy risks are also deemed acceptable in exchange for services beneficial to the individual, depending on the collector of the information (Phelps, Nowak, & Ferrell, 2000).

2.3.1.2 Anonymity/identification

The lack of ability to remain anonymous has been suggested as a major privacy concern when adopting new technologies. Even the collection of minimal pieces of information can jeopardise an individual's privacy and lead to their identification. Research into rebuilding an individual's identity based on data gathered from various social networking sites has shown that a large amount of information can be uncovered by piecing together what is in the public domain (Jedrzejczyk, Price, Bandara, & Nuseibeh, 2009). Jedrzejczyk et al gathered information from a popular online location-sharing service over a period of 76 days. From the accumulation of data, they uncovered names, home and work addresses, e-mails, dates of birth, occupations, shopping habits and other facts about three informed and consenting participants. The participants reported concern about the ability for strangers to

access their location information, believing it was anonymous and being unaware the information was widely available.

2.3.1.3 Information disclosure

People may differ in the way they choose to disclose information. People are regularly required to disclose information to identify themselves in a number of different ways (Karat, Karat, & Brodie, 2007), for example, to gain access to services such as online banking. Sometimes people volunteer lots of information for a small reward, for example store loyalty cards. However, a number of researchers argue that because of potential sensitive information involved, personal disclosure options should be flexible to accommodate individual user needs (Bagüés, Zeidler, Valdivielso, & Matias, 2007; Duckham & Kulik, 2005; Lederer, Mankoff, Dey, & Beckmann, 2003). The type of information that is disclosed has been found to be different for friends, family members and co-workers (Consolvo, et al., 2005).

When faced with information disclosure, the provision of permissions may allow the user to feel more in control of their information. Researchers examined the idea of permissions using an application which allowed participants to divulge information including their location, availability, instant messaging profile and calendar information in a workplace setting (Patil & Lai, 2005). This information was intended to be revealed to their colleagues. The information could be given four different pre-assigned labels: *global*, *team*, *group* and *individual*. Participants then had to configure permissions for ‘when at work’ and ‘when at home’ for each information type. The majority of participants chose to configure their information into group permissions, then team, and finally global (Figure 2.2).

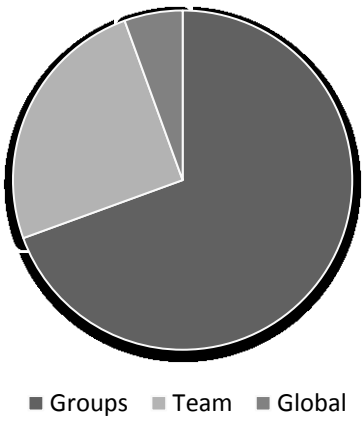


Figure 2.2 Information assigned to groups, team and global (Patil & Lai, 2005)

Importantly, participants did not assign individual permissions, reporting that they required too much configuration, yet the global and team options weren't flexible enough. Despite these flaws, this approach which allowed participants to assign permissions for different people gained strong support.

In terms of location disclosure, people have shown they are willing to provide information, but the *type* of requester is a major deciding factor. In one college study, students were asked 'Which, if any, of the following would you be willing to inform of your current location?' (Anthony, Kotz, & Henderson, 2009). Participants were far more likely to share information with people they could specify on a list (49%) than with their e-mail contacts (10%), or simply anyone who asked (8%). Disclosure was more likely when the participant was alone than with friends, and also more likely at social events, rather than semi-private occasions such as a date. These subtle differences show that divulging location information involves more than simply a yes or no response, and understanding context as well as knowing the requester of information can impact on disclosure levels.

2.4 Privacy as a barrier to LBS uptake

Researchers have suggested that despite initial user enthusiasm, the adoption of LBS may be affected by privacy concerns regarding the sharing of location information (Junglas & Watson, 2008). Despite the emerging use of LBS in social networks, privacy concerns may be able to explain the slower adoption of LBS in the *workplace*. The idea of privacy in an LBS context has been described as 'the ability to prevent other parties from learning one's current or past location' (Beresford & Stajano, 2003, p. 46). Many researchers note the significance of new technologies enabling an individual's location to be catalogued, and the gathering of real-time location information is anticipated to be far more sensitive than recounting past movements. From a safety perspective, it has also been noted that the gathering of location data might encourage unwanted behaviours such as stalking and criminal intent (Harrison & Dey, 2009). However, slow adoption doesn't mean a lack of adoption, and LBS may provide useful services to different people, assuming they feel safe that their information is kept private.

Research has shown that location privacy is highly valued. One study that aimed to assess the value of location privacy across five European countries used the idea of *information auctions* (Cvrcek, Kumpost, Matyas, & Danezis, 2006). These auctions encouraged the exchange of information, and required participants to truthfully reveal how valuable they felt their location privacy was. Results showed that women were more sensitive about the long term use of their location information compared to men. Differences in privacy sensitivity across nationalities were also found, with Greek and Czech participants being much more concerned about location privacy than participants from Belgium, Germany and the Slovak Republic.

Other work in Taiwan has attempted to uncover barriers to using LBS (Chang, Hsieh, Lee, Liao, & Wang, 2007). Using questionnaires and interviews, results showed that cost was a consideration, whilst security and privacy issues, and anxiety about LBS quality affected the *adoption* of LBS. However, because the users in this study were experienced mobile phone users, the complexity of the adoption process was not a significant barrier. In non-technical groups, use of these technologies might be lower because of the knowledge required for successful and effective adoption of them.

2.5 Privacy preferences

Research has called into question the ability for users to fully benefit from new technologies, whilst maintaining a level of control in relation to privacy settings. Researchers also argue that whether or not the user of the LBS system acknowledges it, the process of data collection is ongoing, invasive and they should have some level of control over it (Ignatova & Brinkman, 2007).

Researchers have looked at ways to enable participants to have more control over LBS use. The rationale for some of the previous privacy research focuses on the assumption that different information will be disclosed to different people in different situations. One study aimed to explore the effect of type of inquirer compared with situation type on disclosure levels (Lederer, Mankoff, & Dey, 2003). Using a scenario-based web questionnaire, participants were able to assign themselves one of three 'faces' (true, vague, or blank), which could reveal personal information as well as their location to four possible requesters of information: spouse, employer, stranger or merchant. It was found that participants wanted to assign different faces for themselves, depending on the *requester* of the information.

The inquirer's identity was a better determinant of privacy preferences than situation type, and participants were more likely to use the same preferences for the same inquirer in different situations, than use the same preferences for different inquirers in the same situation.

A similar study by the same researchers confirmed the finding that inquirer and situation are important when considering personal privacy (Lederer, Dey, & Mankoff, 2003). Their study required participants to create a 'face' depending on various social scenarios. This flexibility and self-managed system displayed more success in terms of preserving important private information, compared to automatic disclosure. Configuring 'faces' allowed the user to remain in control of their information, whilst still being able to specify disclosure preferences for different requesters.

Other research exploring privacy preferences suggests that when deciding on disclosure, people consider *who* is requesting information, *why*, and *what* level of detail they are requesting (Consolvo, et al., 2005). In Consolvo et al's study participants were hypothetically asked to send information to people they knew and had been assigned to a 'buddy list'. These requests were either related to their current activity (Figure 2.3) or they were asked for their location.

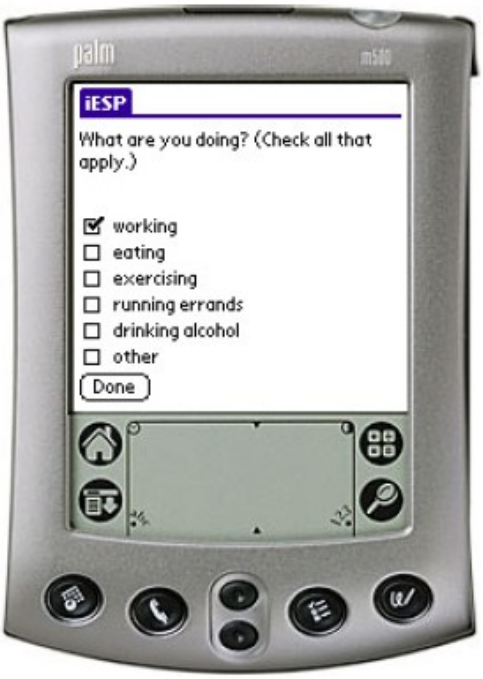


Figure 2.3 A request for activity information (Consolvo et al, 2005)

When asked for their location, participants were given the option of providing the exact address, cross streets, neighbourhood name, generic place name, ZIP code, city, state or country. If the participant did not want to disclose their location, their options were to say 'system busy', 'I am busy', 'request denied', or 'a lie' (which they could specify). Contrary to assumptions that people would refuse to disclose information, participants preferred to disclose *something* of relevance to the requester rather than nothing at all. Participants acknowledged that if people wanted to know their location, they would appreciate full details or no information at all. Spouses, friends, and family were given true location information 93%, 85% and 83% of the time respectively, whereas co-workers and managers would only be told accurate information 53% and 34% respectively. Confirming earlier work related to requester importance, the response given was dependent on who asked for information. For

example, a friend in another country requesting information might only be told of the state the person was in, rather than detailed address information.

Another study aimed to discover when, where and with whom people would be comfortable sharing their location information, using a novel device (Benisch, Kelley, Sadeh, & Cranor, 2010). This research also examined the desire for privacy control amongst users of LBS technologies, and if given the opportunity, the way they would manage their own data disclosure. As with many of these studies, participants were asked about disclosure to specific groups, in this case: *close friends and family, Facebook friends, the university community,* and *advertisers* (see Figure 2.4). Participants were asked if they would disclose their location information to each group for the duration that they were at a particular place.

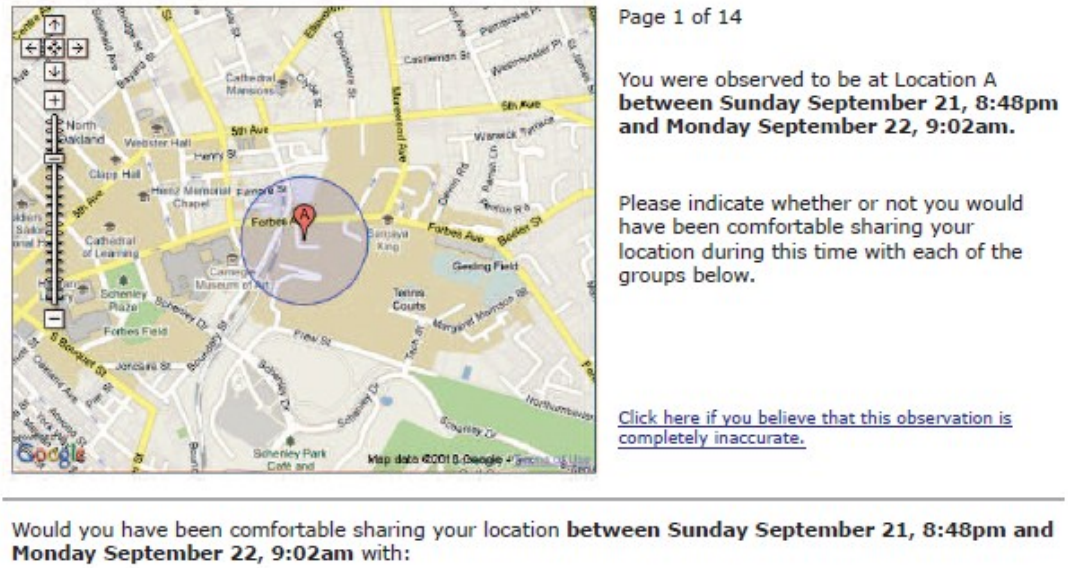


Figure 2.4 A screenshot of the user interface (Benisch, et al., 2010)

Benisch et al's pre-study survey indicated that people were more comfortable sharing location information with close family and friends compared with Facebook friends,

people at university or advertisers. Policy rules were created to try and account for all privacy settings required for participants. Disclosure could either be based on a white list (information provided to everyone on that list), a location, time, time with weekends included, location *and* time, or location and time with weekends included.

Results suggested that disclosure to friends and family was largely unaffected by time of day or day/week, but different prefences emerged for the other groups. In particular, participants preferred some time or location-based rule for Facebook friends, people at university or advertisers, rather than white lists. When attempting to create a policy using these rules, none were able to achieve 100% accuracy. Essentially, a rule could not be created that would satisfy all possible disclosure combinations for the participants. However, the researchers felt that more complex privay settings could 'add substantial value for privacy-sensitive users' (Benisch, et al., 2010, p. 12).

These studies exploring privacy preferences show that people can be discerning when using new technologies and that when deciding how to disclose information, context as well as knowledge about *who* is requesting information is extremely important. Previous research also shows that people are capable of comprehending a technological system, and adapting settings to their advantage. In one study focusing on employee tracking, participants even requested to have a lie mechanism embedded in the device to enable them to provide false information to requesters (Iachello et al., 2005). The remainder of this chapter will explore further the way in which privacy can be managed by the individual, and they way technology has been designed to enable this.

2.6 Privacy concerns and LBS adoption

One way in which we can predict what will influence the uptake of LBS is to understand what privacy concerns individuals have, and how these can be alleviated. Researchers have suggested that the level of *perceived control* a user feels they have may influence their privacy concerns and how much they intend to use the technology (Xu & Teo, 2004). Exploring an LBS application, Xu and Teo assessed privacy by testing three different mechanisms of assurance control: *technology control, self-regulation*, and *legislation control*. The technology control manipulation allowed participants to interact with the graphical interface of the mobile device (Figure 2.5). In the self-regulation scenario, participants were presented with a 'TRUSTe seal' on a service provider's website, hypothesised to provide legitimacy and trustworthiness. Legislation control was manipulated by showing participants a news report indicating that LBS were being governed by a new 'privacy protection law', emphasising legal assurances (Xu & Teo, 2004).

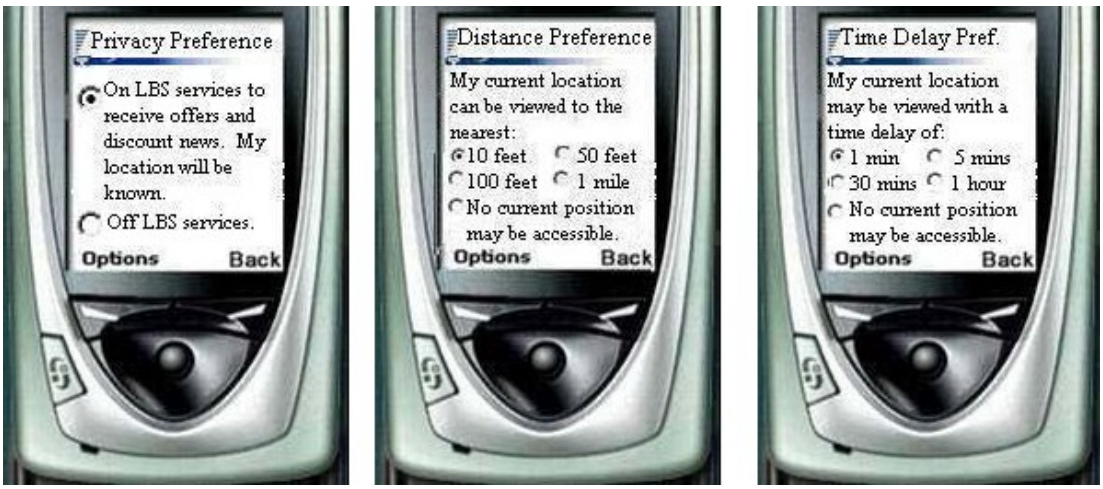


Figure 2.5 The 'technology control' manipulation interface (Xu & Teo, 2004)

Measuring privacy concerns and intentions to use LBS, analysis of questionnaires revealed that technological assurance (allowing the participant to modify settings on the mobile device) played the most important role in accounting for perceived control, compared to trust statements or news reports. These findings suggest that users of LBS technology perceive a lower level of privacy concern 'when they themselves act as the control agent' (Xu & Teo, 2004).

2.6.1 Privacy management

The provision of control over information has been described as one way in which people could learn to trust and use pervasive systems (Karat, et al., 2007). A number of privacy preserving techniques have been suggested in order to enable the individual to control their own information disclosure. However, it is not clear whether the privacy control mechanisms described so far (assigning faces, allowing information to be less accurate, graphical interface preferences) are enough to encourage wide LBS use. Some LBS systems have also been set up which attempt to protect the individual, but which they may have no control over. For example, when someone using LBS gets a request to disclose their location some systems ask for a number of other locations from the LBS, used as fakes, so the real requester location is unknown (Ghinita, 2008). Another solution involves encoding the data given to the service provider, which cannot be understood until the data owner (device user) gives permission to access it.

Less technical solutions to alleviate privacy concerns have been as simple as restricting physical access to the data. Researchers in Spain tested a local positioning system, *ZUPS*, which was designed to help navigation for elderly and disabled

people (Marco et al., 2008). This system detects abnormal patterns of movement or stationary periods which may indicate danger. The novelty of the system lies in the information it discloses. Each *ZUPS* system is assigned to an appropriate caregiver, depending on the type of alarm raised, which reduces the need for universal exposure of information. The service also only reveals where a user is when an alarm sounds and does not store any history of the users movements.

Research has suggested a number of ways in which privacy concerns could be reduced, for example using an invisible mode whereby information is completely unavailable to data observers, yet location can still be disseminated to people on a friends list (Hong, et al., 2004). Conducting interviews with potential LBS users Hong et al found that the involvement of a trusted third party using an 'opt in' system, rather than constant data collection was also preferable.

Despite the majority of LBS historically being used with mobile phones and more recently smart phones, research is beginning to acknowledge the use of other online platforms as a way to disclose location. One way that LBS and privacy has been explored is through the use of feedback, and allowing users a degree of reciprocity (Tsai et al., 2009). Using a Facebook interface (Figure 2.6), researchers deployed an LBS platform to participant's profiles on a month-long trial. The novelty of this trial lay in the Facebook platform, called 'Locyoution', which enabled the already linked friends to view their each other's location. Participants were split into two groups, with only one receiving feedback about location requests. Feedback allowed participants to identify which users had asked to view their location and when, by means of a 'Who Has Viewed Me' tab (Figure 2.7).

Figure 2.6 The Facebook platform 'Locyoution'

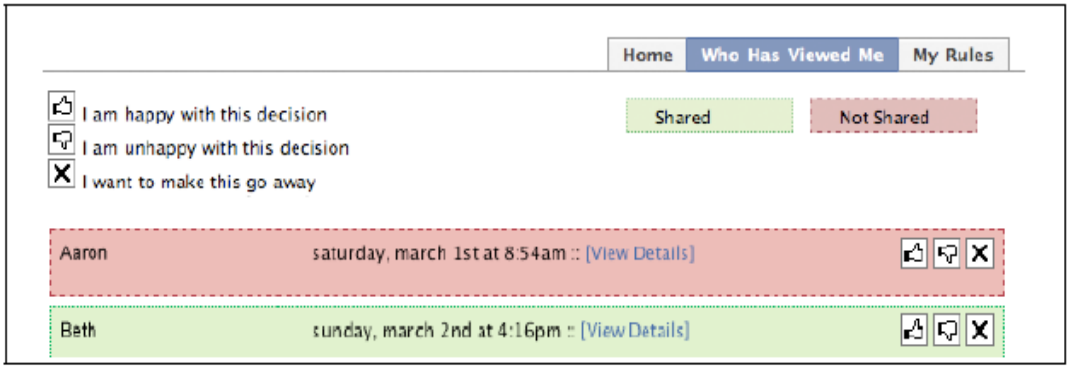


Figure 2.7 The Locyoution 'Who Has Viewed Me' screen

The group who received no feedback were found to be less comfortable disclosing their location information to others. In comparison, people who had received feedback became more comfortable sharing their location information with friends

and strangers, and experienced a lesser degree of concern for their privacy after using the technology. This trial suggests that by building in feedback to technological systems and encouraging reciprocal disclosure, privacy concerns can be reduced. These findings highlight the importance of the requester of information, and show the potential for increased disclosure when both parties benefit from sharing.

2.7 Chapter summary

This chapter has summarised the early constructs of privacy by Westin and Altman. Issues of privacy related to technology use have been highlighted, with research suggesting that the type of information gathered is a significant factor associated with technology use (Ackerman, et al., 1999), yet people may be willing to trade their information for personal gain (Phelps, et al., 2000). However, with the emergence of new technologies, privacy issues have changed in nature. The face to face interactions we can actively control are being replaced with online exchanges which warrant a different approach.

Location information is regarded as highly sensitive (Cvrcek, et al., 2006; Jedrzejczyk, et al., 2009). When disclosing location information, the receiver is a major consideration, with people preferring to control who sees what (Anthony, et al., 2009; Patil & Lai, 2005). The ability to know who is viewing this information, and when, is likely to be a major consideration for potential users of LBS systems.

One privacy issue that has been raised is whether people will be able to implement technological controls and use them effectively (Karat, et al., 2007). Examples of ways in which the user of LBS can control their own privacy settings have been shown to be successful; however the main way LBS privacy has been explored is

with prototypes and hypothetical scenarios which lack ecological validity. Researchers have recommended ways in which designers can improve the technology to benefit the user (e.g. Hong, et al., 2004), but only by understanding who the users *are*. In-depth explorations of user perceptions and *attitudes* towards LBS technology are yet to be fully explored.

The next chapter will describe various research methodologies that have been used to assess LBS, and a summary of what research *has* uncovered about user attitudes towards LBS. It will also describe existing theoretical frameworks which have helped guide the research in this thesis, with a focus on the most current theoretical framework developed to understand LBS to date.

CHAPTER 3: RESEARCH APPROACHES TO THE STUDY OF LBS

Chapter 2 highlighted the privacy issues that surround technology use and LBS in particular. It also focused on ways in which LBS have been assessed to enable potential users to have more control over their location information. However, these assessments of technical ability do not explore user attitudes relating to LBS. This chapter considers relevant research methodologies, as well as exploring the frameworks that have been suggested to assess LBS, and highlights what is needed to better understand user experiences of LBS technology.

3.1 Research methodologies

3.1.1 Subjective user reports / Interviews

Researchers are becoming more aware of the need to involve participants before, during and *after* technology trials. One example of this shows the value in gathering qualitative subjective data as well as technical performance data; in 2003 researchers based at Intel devised hypothetical laboratory software called Place Lab. The aim of Place Lab was to provide low-cost convenient LBS technology which would be valued and accessible to a large user community (Schilit et al., 2003). Place Lab proponents anticipated it would work via a website, so that whenever a user visited the webpage (termed the 'Place Bar'), nearby overlapping Wi-Fi hotspots in a directory could determine their location. In 2006 the researchers developed this technology further, with Place Lab being accessible 'on laptops, PDAs, and cell

phones with different operating systems' (Hightower, LaMarca, & Smith, 2006, p. 32).

Whilst considering the implications of creating this system, the researchers noted that users may lack trust in the system. They also acknowledged the difficulties in moving LBS research from the laboratory to the real world, but their proposal was to develop a system that would build a community feeling. In order to assess how users of Place Lab might feel about disclosing their location, a mobile phone LBS system was tested with sets of families and their friends in Seattle.

In order to understand users' privacy concerns and feelings about location disclosure, interviews were conducted with participants before and after deployment. This gave users the opportunity to self-report how they did or did not use the system. The researchers noted one instance whereby a participant reported numerous occurrences of location-sharing with friends. However, the phone logs revealed almost none of the scenarios they described. The researchers pointed out the importance of cross-checking self-reports with the real device context, which in this case enabled them to understand a participant's willingness to use the technology, rather than how they *actually* used it (Hightower, et al., 2006). This example importantly illustrates the difference between subjective intentions to use, and actual use of such a system.

Other LBS trials have also utilised self-reports or interviews with participants. A location-aware memory aid, *comMotion*, was designed to track the user and provide reminders about potential errands they needed to complete when in a particular area (Marmasse & Schmandt, 2000). The comMotion aid presented users with a map, and after visiting a place repeatedly, the system would ask users to name it e.g. 'grocery

store'. This would require the user to verify the location with a speech command, rather than a button-press response. When a user approached a named location, the system would indicate if they had any errands to complete there. Friends, family members, office colleagues, and other authorized persons could also send reminder notifications to the user on their arrival at a particular place.

Four trial users were asked about their experience of using the comMotion technology, and they raised issues regarding hardware, speech input, precision and alert notifications. For example, they advised that the hardware needed to become smaller and lighter, or the aid could possibly be integrated into an already familiar device such as a mobile phone. Participants raised privacy concerns when asked to give speech commands, as they did not want other people to know what they were doing. They also noted problems with speech recognition and accent differences.

3.1.2 Questionnaires / surveys

Questionnaires and surveys are another way of understanding user experience of technology after a trial. For example, researchers designed a wristwatch called *WatchMe*, so people could share their location with friends and family (Marmasse, Schmandt, & Spectre, 2004). The watch face displayed everyone using the system, so the wearer could click on their image to display their location. Using an online survey, this prototype was assessed by people using scenarios involving WatchMe. In their evaluation phase, users were asked how easy the system was to use (using a 1-7 Likert scale), as well as how much they liked the system, and who they would share information with when using it. Participants positively rated the system and said they would use it to communicate with their spouse, siblings, parents or close

friends. Taking Likert scale measures was found to be a simple and quick way for users to provide feedback about the technology.

Another system assessed in this way, 'Newport', was designed to allow increased sharing during mobile phone calls (Gunaratne & Brush, 2010). For example, a user could utilise this system to share pictures, data files, or their location with the call recipient. The system allowed users to disclose location information during the phone call, but this would cease when the phone call ended. The researchers gave participants a survey to assess their feelings towards the Newport system. Measures of existing location-sharing behaviour were taken before the trial, and participants said they did not particularly like to share with others. Results after the trial suggested that the system was perceived positively, and users expressed they *would* be interested in sharing their location information during a phone call.

3.1.3 Laboratory studies

Another approach that has been used is controlled laboratory experiments. Often these methodologies complement each other, and a laboratory trial may be coupled with a user interview or questionnaire. This triangulation approach provides an opportunity to validate data, and previous research exploring LBS has already highlighted the need for use of multiple methodologies (Hightower, et al., 2006). Despite the obvious problems with ecological validity, researchers have acknowledged that a laboratory-based study enables control of accuracy and slow response times of technology, as well as a reduction in external disturbances that may affect the user (Junglas & Watson, 2008). The nature of LBS technology means

that trials are often set in the real world, however a limitation of this approach is that the *tasks* participants are required to complete are often superficial in nature.

One example of this controlled methodology was conducted by Junglas and Watson (2008) who wanted to explore the difference between location-tracking and location-aware services. In their LBS trial, 58 participants were given PDAs and required to complete three tasks in a restricted office block area: they were asked to find a moving person (location-tracking), find a local office (location-aware), or given a basic task such as writing an e-mail (no location). Every participant was assigned to one of two experimental groups: one group had location-tracking and location-aware functionalities, while the other was provided only with wireless connectivity. Measures of performance, usefulness and ease-of-use were recorded. Participants reported location-tracking as having a high level of perceived usefulness and ease of use. In order to explore perceptions further the researchers carried out informal interviews with participants, who reported equal measures of enthusiasm and concern regarding the technology (Junglas & Watson, 2008). The technical capabilities of the tracking system were deemed positive, but participants also reported feeling alarmed at the ability of the technology to track people. One obvious drawback with this type of study is that the closed nature of the trial means that genuine privacy concerns may not be uncovered.

3.2 Attitudes towards LBS: what has been done?

Despite a lot of research being dedicated to user privacy issues (Chapter 2), the evaluation of user attitudes towards LBS in general has been neglected. The studies described in sections 3.1.1, 3.1.2, and 3.1.3 suggest that in order to get detailed and

useful feedback regarding user preferences, a more directed and personal approach should be taken. These studies show that multiple approaches to the assessment of LBS are required to truly understand user perceptions and significantly increase our knowledge of this technology.

One way that technology, and more recently LBS, have been studied is with the development of theoretical models which aim to predict adoption by utilising questionnaire methods. For example, researchers suggested a model to explore employee attitudes towards monitoring in the workplace (Workman, 2009). The research posited that despite employees complying with monitoring policies, their attitudes about them may differ and impact on other aspects of work life. Employees working for a multinational company were given a questionnaire with items measuring organisational threat severity, effectiveness, vulnerability, self-efficacy, trust, procedural justice and absenteeism in relation to monitoring.

Results indicated that greater perceptions of vulnerability to security threats, self-efficacy, company security, and trust would result in more positive attitudes towards monitoring. Attitudes towards monitoring were also found to improve when employees had more positive perceptions of organisational procedural justice, and more positive attitudes also led to lower absenteeism. The researchers concluded that ensuring transparency of monitoring methods, and providing a rationale for implementation would improve employee perceptions. In the next section, models of technology acceptance will be explored, as well as the main theoretical model that has been used to explore intentions to use LBS.

3.3 Existing theoretical frameworks

3.3.1 The Technology Acceptance Model

A number of theoretical frameworks developed to investigate LBS have evolved from the Technology Acceptance Model (TAM). The TAM was itself developed as an extension of the Theory of Reasoned Action (TRA) model (Ajzen & Fishbein, 1980). The TRA posits that behavioural intentions can be predicted by attitudes towards that behaviour, and subjective norms. The TAM attempts to predict acceptance and actual use of computing technologies (see Figure 3.1).

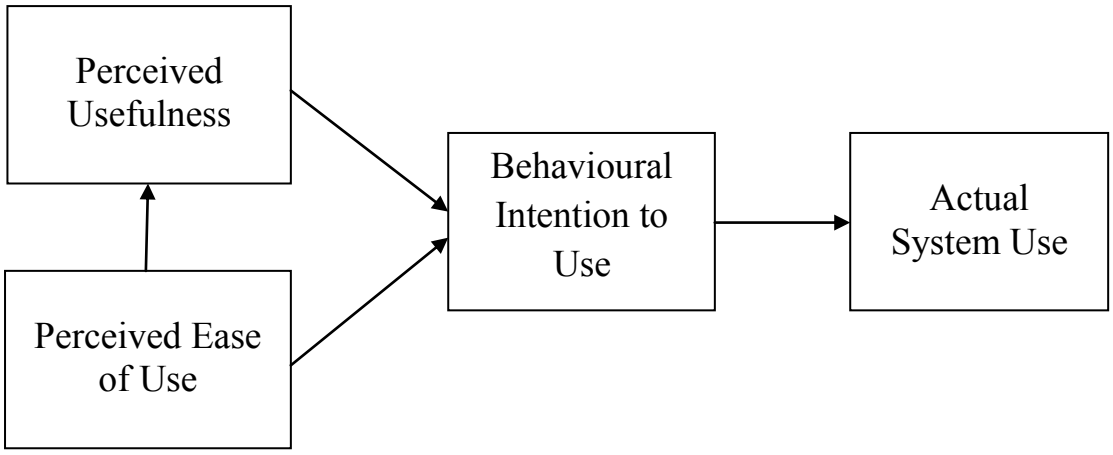


Figure 3.1 The Technology Acceptance Model (modified from Davis et al. 1989)

The TAM hypothesises that system use will be determined by behavioural intentions to use it, which are influenced by perceived usefulness of the technology, and perceptions of its ease of use (Davis, Bagozzi, & Warshaw, 1989). This model has been used to test the adoption of a variety of technological systems, including e-mail and the World Wide Web (Fenech, 1998; Gefen & Straub, 1997). For example, the TAM was also extended to predict adoption of mobile wireless technology (Kim,

2008). This model added two predictors of mobile phone use: perceived cost savings (PCS) and company's willingness to fund (CWF). Two causal relationships were also added: job relevance and experience. Kim found that PCS and CWF accounted for 62.7% of behavioural intention. Importantly, perceived usefulness and perceived ease of use continued to be significant predictors of technology use.

3.3.2 The UTAUT model

The numbers of models predicting technology adoption have grown, and some researchers have attempted to bring the competing ideas together to create a unified model of technology acceptance. Looking at eight of the most common models, the Unified Theory of Acceptance and Use of Technology (UTAUT) was developed (Venkatesh, Morris, Davis, & Davis, 2003). This model suggests that *performance* and *effort expectancy, social influence, facilitating conditions, gender, age, experience* and *voluntariness of use* all influence behavioural intention, and ultimately use behaviour (Figure 3.2). Whilst this theory encompasses many factors which may not account for all technologies, it is described here because it is one of the few frameworks which consider individual differences. The constructs, although labelled differently, also account for universally accepted predictors of intention such as perceived usefulness.

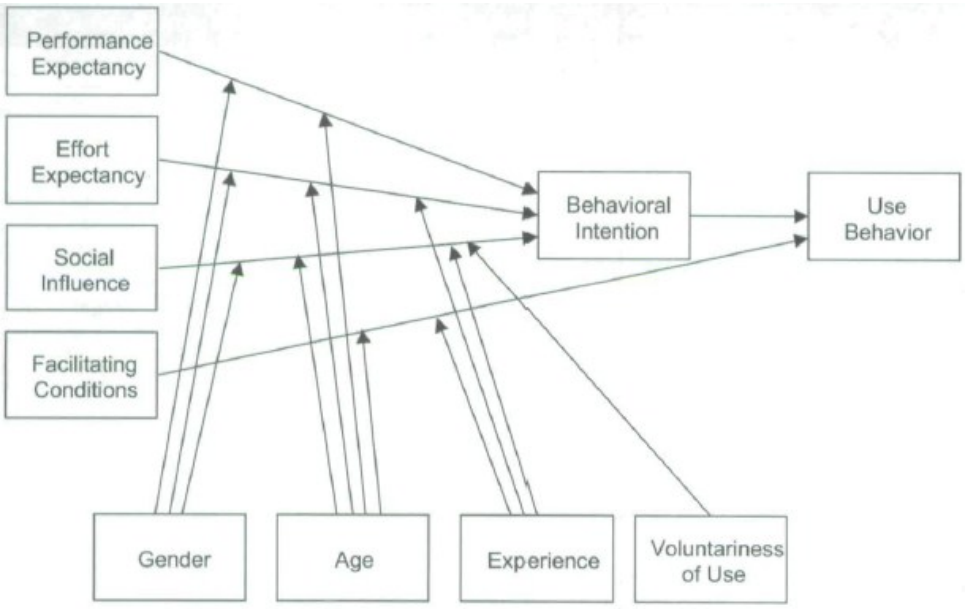


Figure 3.2 The UTAUT framework (Venkatesh at al, 2003)

Despite these revisions of the TAM, the original concepts have generally been thought of as a useful starting point when exploring technology acceptance (Chen, Gillenson, & Sherrell, 2002). However, predicting use of LBS technology may involve additional factors.

The ways that LBS adoption has been theorised in the literature will now be considered, as well as an explanation of the theoretical model devised by Junglas and Spitzmüller (2005). This is the framework used to assess the research described in chapter 4 of this thesis.

3.4 Theoretical models to assess LBS use

A detailed overall theoretical model to predict intentions to use LBS services would be of great value. Understanding the motivating factors behind LBS adoption would provide a much needed theoretical framework for psychologists, as well as giving

designers and LBS providers an insight into their customers' needs. Previous research has suggested models predicting technology uptake, however they tend to focus on perceptions of the technology, rather than intentions to use it (Moore & Benbasat, 1991).

3.4.1 The Perceived Values model

The Perceived Values model was designed to predict intentions to use LBS. This model focuses on values relating to LBS adoption. The model (Figure 3.3) cites social, emotional, conditional, monetary, convenience and epistemic values as predictors of commitment and behavioural intention (Pura, 2005). Items in the model were chosen based on a cumulative review of previous research, suggesting a rationale for each inclusion. In this instance, the authors hypothesised commitment related to the tendency to remain loyal to one service provider, with increased commitment resulting in greater intention to utilise the technology.

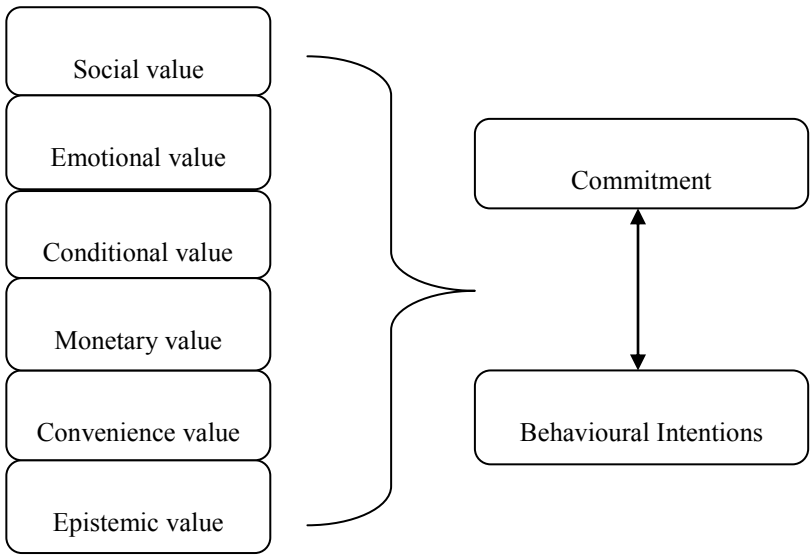


Figure 3.3 Research model to predict intention to use LBS (Pura, 2005)

Questionnaires were distributed online to subscribers of a pre-existing location-tracking service. Factor analysis suggested that conditional values (the context in which the service is used) and commitment had the strongest influence on behavioural intentions to use LBS. Structural modelling also supported the constructs, with overall good fit statistics.

Whilst this model considers user attitudes towards LBS and how they may affect intentions, the focus on socio-emotional values means other potential influences on LBS use are ignored. For example, trust and privacy issues, and the identity of the requester of information have been shown in previous research to be important when deciding to use LBS. This omission may be influenced by the type of LBS technology assessed in this study. Importantly, this research adopted the use of a directory service provider 'that allows people to find the nearest service location by ordering the information with the help of a text message' (Pura, 2005, p. 520). This use of a location *aware* system may not raise the same privacy concerns as a location tracking one, and this model can only account for a small aspect of the LBS experience. The researchers reported that targeting current users of LBS is most beneficial, as 'non-users usually have no realistic perception of the service' (Pura, 2005, p. 521). However, there is still a need to understand what influences *new* uptake of LBS.

3.5 A Research Model: Junglas and Spitzmüller

Looking at models predicting LBS use, the leading theoretical contribution to our understanding comes from Junglas and Spitzmüller (2005). This model predicts that *personality traits, task characteristics, technology characteristics, perceived privacy,*

trust, perceived risk and *perceived usefulness* will account for intentions to use LBS (see Figure 3.4). Specifically, the model hypothesises that technology characteristics, task characteristics and personality differences will influence privacy perceptions, which will in turn impact on perceptions of usefulness, trust, risk, and therefore intentions to use LBS.

Junglas and Spitzmüller developed this model after considering growing reports of privacy concern relating to location-tracking practices. In particular they felt that since the emergence of the E911 legislation (see chapter 1), the potential for widespread implementation of LBS in government, business or marketing arenas could exacerbate privacy concerns. They summarised that research needed to develop 'viable models to predict under which circumstances consumers will adopt LBS' (Junglas & Spitzmüller, 2005, p. 2). Their model borrowed items from previous technology models (perceived usefulness from the TAM, for example), as well as other recognised constructs believed to be important in decision making (e.g. personality traits). The items from the model will be described in more detail.

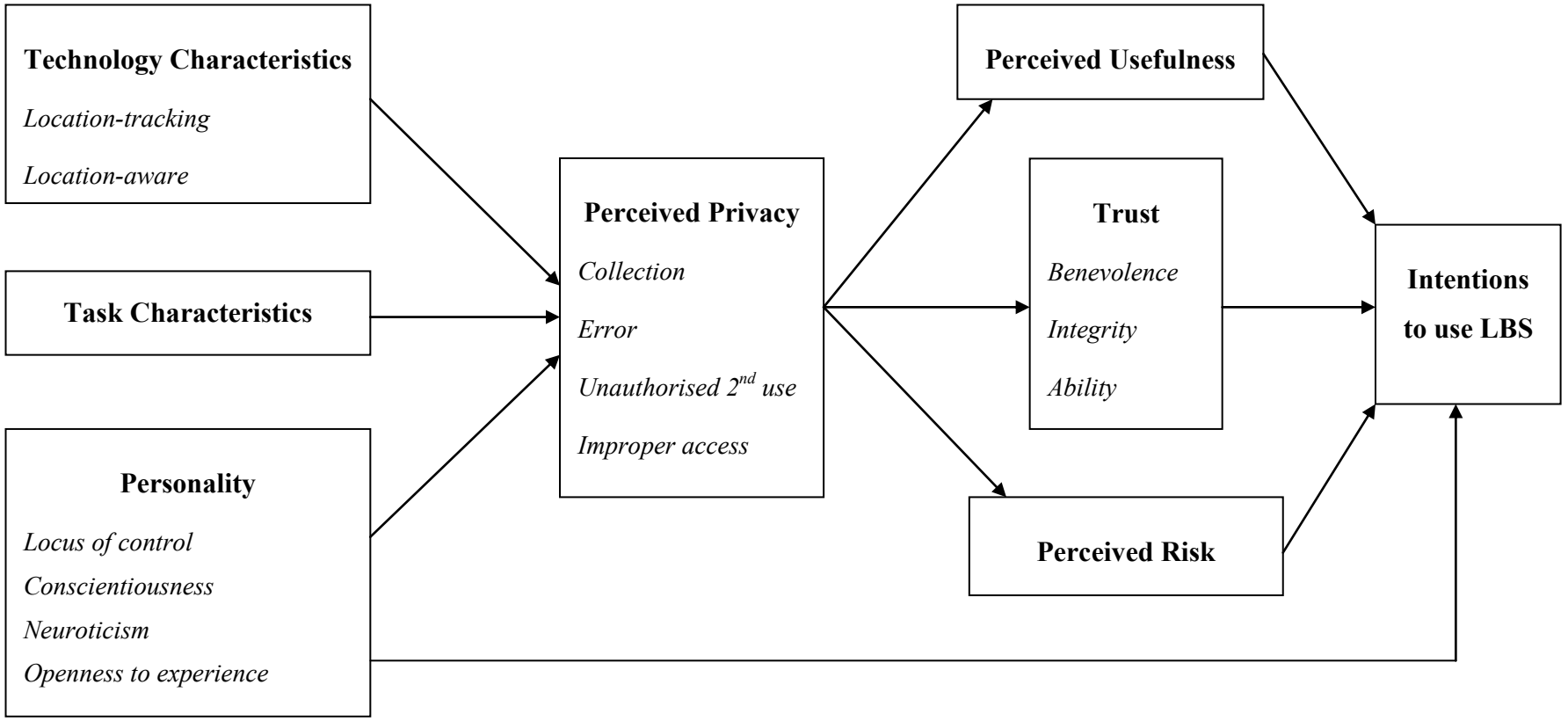


Figure 3.4 A research model for studying privacy concerns pertaining to location-based services (Junglas & Spitzmüller, 2005

3.5.1 Technology Characteristics

LBS have either 'location-tracking' or 'location-aware' capabilities. Location-tracking allows a third party to gain access to an individual's location information, whereas location-aware services only allow the individual to request information which is relevant to their location. Location-tracking systems have been shown to generate more concern than location-aware ones (Barkhuus & Dey, 2003).

3.5.2 Task Characteristics

Junglas and Spitzmüller suggested that a user's need for privacy will be influenced by how well the location-aware or location-tracking services fit the 'task at hand'. For example, if an employee is in a risky environment away from their office, they may be more receptive to a location-tracking system than if they were at home.

3.5.3 Personality

Personality factors are thought to be of relevance when predicting adoption of a technology. In particular, issues of control are said to be of great importance (Junglas & Spitzmüller, 2005). For this reason, locus of control (Rotter, 1966) is included in the model framework. People with a high internal locus of control are thought to be more trusting of technology compared to those with a high external locus of control. Junglas and Spitzmüller also defined three other personality items to be included in the model from the Big Five framework: conscientiousness, neuroticism, and openness to experience. The remaining Big Five measures excluded from the model are extraversion and agreeableness. These five factors have become a widely accepted and comprehensive personality measure (McCrae & Costa, 1987). High levels of conscientiousness are expected to induce positive feelings towards LBS.

Junglas and Spitzmüller suggest people who are high on the neuroticism scale are expected to feel threatened by, and less likely to use LBS. Individuals who have high levels of openness are expected to have fewer privacy concerns relating to LBS use.

3.5.4 Perceived Privacy

Junglas and Spitzmüller state that privacy perceptions are integral to determining LBS use. They proposed using items from an existing instrument designed to measure privacy concerns in an organisational context (Smith, Milberg & Burke, 1996). This instrument consists of 4 types of privacy: Collection of Personal Information, Unauthorized Secondary Use of Personal Information, Errors in Personal Information and Improper Access to Personal Information.

Collection of information refers to personal and identifiable data. In relation to internet data, for example, collection of information has been shown to contribute to increased user concerns (Malhotra, Sung, & Agarwal, 2004). It has been suggested that organisations should 'collect the minimum amount of information needed', and people should be 'told in advance what will be done with their information' (Karat, et al., 2007, p. 250). Unauthorised secondary use of personal information describes the practise in which information is collected for one purpose, but is used for another without authorisation from the individual. Errors in personal information refers to stored personal data which may contain 'deliberate and accidental errors' (Smith et al., 1996, p. 172). Improper access to personal information has been described as data which is 'readily available to people not properly authorised to view or work with the data', (Smith et al., p. 172). Junglas and Spitzmüller explain that perceived privacy is more likely to be mediated by trust and perceived risk than influencing intentions directly.

3.5.5 Perceived Usefulness

Previous models of technology acceptance have included the idea of perceived usefulness (e.g. Davis, et al., 1989). Junglas and Spitzmüller argue that perceived usefulness will still play an important part in predicting intentions to use LBS. They also suggest that perceptions of usefulness will mediate intentions with privacy as a *precursor*. For example, if LBS are deemed as too intrusive this may influence a person's perception of their usefulness.

3.5.6 Trust and perceived risk

With the growth of LBS applications, it has been argued that the potential for erosion of trust in society may have a greater impact than we could anticipate (Perusco & Michael, 2007). Research into trust has suggested the concept can be divided into three categories: *benevolence*, *ability* and *integrity* (Mayer, Davis, & Schoorman, 1995). Benevolence, in this context, refers to the assumption of a positive relationship between a consumer and a service provider. This trust component depends on the consumer believing the service provider has an interest in providing a fair and respectful service to them. Ability refers to the competence of the service provider in managing and keeping the consumer's location information safe. Integrity refers to predefined rules, possibly industry-specific, which have been agreed by the consumer and LBS provider. Risk is also proposed as 'inseparably intertwined' with trust issues, and is expected to be a direct antecedent of intentions to use LBS (Junglas & Spitzmüller, 2005).

3.5.7 Intentions to use LBS

Research has suggested that behavioural intentions are a good predictor of actual behaviour (Fishbein & Ajzen, 1975). The greater a person's intentions to use LBS, the greater the likelihood they will engage with the technology and use it.

3.6 The Junglas and Spitzmüller methodology

After defining the model items, Junglas and Spitzmüller proposed two methodologies to explore its utility. First, they described an exploratory survey approach, which would use scenarios to enable participants to envisage using LBS technology. These scenarios would differentiate between location-tracking and location-aware capabilities. The scenarios would be accompanied by a questionnaire which would include all elements of the model, using recommended measurement items. The questionnaire was to be tested with students. The second approach suggested by Junglas and Spitzmüller involved exposing participants to LBS in a controlled environment, using personal digital assistants (PDAs). They suggested that participants should be able to use the LBS system to explore location-aware and location-tracking abilities. After the trial, participants would again be given a questionnaire based on the model. Despite these clear aims however, Junglas and Spitzmüller did not carry out any testing of the model, or run experimental studies with participants. At the time of the paper, they discuss enlisting 120 students from a southern US university to test their model using a questionnaire.

In summary, Junglas and Spitzmüller describe a complex, but not evaluated model, which aims to predict intentions to use LBS. The items in the model were carefully considered, and the researchers suggested appropriate questions which could be used directly from existing validated measures. They did continue to explore smaller

sections of the model, such as the difference between location-aware and location-tracking perceptions (Junglas & Watson, 2008) and personality issues (Junglas, Johnson, & Spitzmüller, 2008), however they did not explicitly test this LBS model in its entirety. This untested model has left a gap in the area of LBS research, and assessing it would provide insight into what is important when deciding whether to use LBS. One of the aims of this thesis is to provide an explicit test of the Junglas and Spitzmüller model.

3.6.1 Understanding Different Contexts

The existing literature suggests that there is a distinct lack of understanding when it comes to the use of LBS in different contexts. As described in Chapter 1, LBS are said to have four main applications- 'Where am I?' queries, Point of Need Information Delivery, Niche Consumer Applications and Corporate Applications (Rao & Minakakis, 2003). Different populations will use these types of LBS in different ways. For example, friends may use LBS via Facebook to communicate where to meet, families might use LBS technology to locate a vulnerable elderly relative, or employers could use LBS to locate their out of office employees.

However, the methods described in the literature focus on small-scale trials, often with assessment of participant attitudes carried out after the experimental manipulation, or not assessed at all. The participants involved in LBS research are often also from a student population, who may have no real desire or need to use a formalised LBS system. The only way to understand how people perceive LBS, and what can be done to enable its successful development is to target these different user groups, using different methodologies. To date this has not been achieved by any

researcher in the field of LBS, and is not just an omission from the work of Junglas and Spitzmüller.

3.7 The research approach for the thesis

To recap, there are two main research questions which will be addressed in this thesis:

1. *What predicts LBS use, and what role does privacy and disclosure play?*
2. *What different contexts affect attitudes towards LBS use?*

To explore the first research question, a model first suggested by Junglas and Spitzmüller (2005) was tested using a questionnaire, with potential users of LBS in a work environment (chapter 4). This model was then revised and reassessed with a further questionnaire (chapter 5).

In order to explore privacy and disclosure issues, another study (chapter 6) assessed types of location information and how people categorised that information. Location scenarios were devised by participants and they were then asked to consider location disclosure to different types of people.

To understand which contexts may affect perceptions of LBS use, in-depth qualitative interviews were conducted with people from three different contexts; a university researcher who used LBS as a lone-worker, a group of older adults who had taken part in a trial study using LBS, and a family who had a son with ADHD and Aspergers, who used LBS at home. The LBS issues relating to each context, and the findings from these interviews are discussed in chapters 7, 8 and 9.

CHAPTER 4: TESTING A MODEL TO PREDICT LBS USE

As shown in chapter 3, there is no verified model which can account for LBS uptake. The model suggested by Junglas & Spitzmüller (2005) was only proposed to explain intentions to use LBS, and never tested. For this reason, the aim of the first study in this thesis was to develop a questionnaire which utilised the constructs identified in the Junglas & Spitzmüller model, and to assess it with a relevant population. This chapter will discuss the pilot study which tested the questionnaire items, and then outline the main questionnaire which was sent to *employed* people working in the UK.

4.1 Questionnaire Item Development

As outlined in the Junglas & Spitzmüller model, technology characteristics, task characteristics, personality items, perceived privacy, perceived usefulness, trust and perceived risk were hypothesised to predict intentions to use LBS (Figure 4.1). The first questionnaire was designed so that it would tap into all the hypothesised constructs of the model. It was also the aim to design a questionnaire which would assess LBS intentions with people likely to use the technology. This research was conducted with support from local company Trackaphone (discussed in Chapter 1), therefore the questionnaire outlined in this chapter was completed by people in a work environment, and they were asked specifically about using LBS in that environment. The following sections describe how the constructs were represented in the questionnaire.

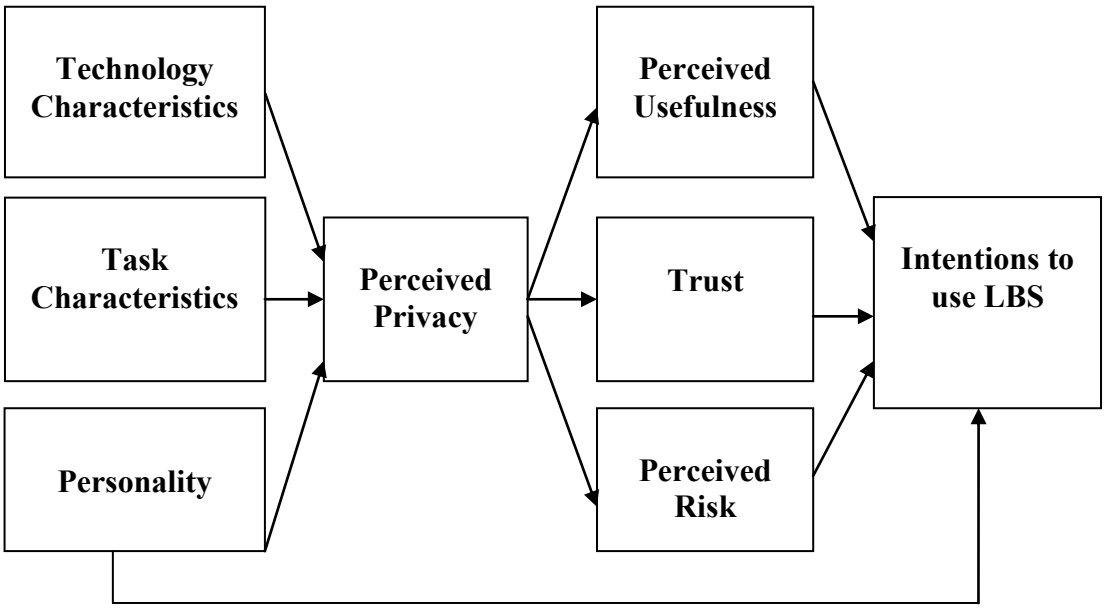


Figure 4.1 The research model (Junglas & Spitzmüller, 2005)

4.1.1 Technology characteristics

Junglas & Spitzmüller (2005) differentiate between location-tracking and location-aware technologies. The research in this thesis is focused on location-tracking characteristics, and therefore the questions related specifically to location-tracking. The concept of location-tracking was summarised for participants at the beginning of the questionnaire by means of an introductory paragraph about LBS.

4.1.2 Task characteristics

Task characteristics relate to different scenarios which may be encountered when using location-tracking technology. In this case, the aim was to find how well LBS technology would fit with employee objectives. In the questionnaire, items related to who might be accessing a person's location information, for example, '*I would find LBS acceptable if I was working alone.'* These questions were devised by the

researcher; Junglas & Spitzmüller gave no indication of existing or recommended task characteristic measures.

4.1.3 Personality measures

The personality measures hypothesised to influence intentions to use LBS were neuroticism, conscientiousness, openness to experience and locus of control. To measure neuroticism, the Eysenck Personality Questionnaire (EPQ-R Short Scale) was used (Eysenck & Eysenck, 1991). This consisted of 48 questions with Yes/No answers, for example, '*Do you enjoy meeting new people*?' This scale also measures extroversion and psychoticism. Despite these constructs not featuring in the model, all items were retained.

A Ten Item Personality Inventory (TIPI) (Gosling, Rentfrow, & Swann, 2003) was used to measure conscientiousness and openness to experience, as recommended by Junglas, Johnson and Spitzmüller (2008). Questions included items such as '*I see myself as dependable, self-disciplined*' (conscientiousness) and '*I see myself as conventional, uncreative*' (openness). This scale also measured agreeableness, emotional stability, and extraversion. As before, all items were retained.

In order to measure locus of control, a shortened version of the Rotter scale was used (Rotter, 1966). The scale comprised of a 20-item questionnaire for which participants had to agree or disagree, for example '*What happens to me is my own doing*' (Lauder, 1993).

4.1.4 Perceived privacy

A scale to measure perceived privacy was identified by Junglas & Spitzmüller and used in the questionnaire with slight modifications. The original scale devised by Smith, et al. (1996) referred to companies collecting information, and was divided into four concern for privacy categories: *collection of information, error in information, unauthorised 2nd use of information and improper access to information* (see Chapter 3 for detailed category information).

This privacy scale was updated (see Junglas, et al., 2008) and items referred to employers and LBS use, for example '*It bothers me if my employer stores my location information.*' Further items were included from scales relating to information storage, for example '*I feel I have very little power to keep organisations from storing personal information about me*' (Stone, Gardner, Gueutal, & McClure, 1983) and '*I feel confident my privacy will not be compromised*' (Pavlou, 2001).

4.1.5 Perceived usefulness

Usefulness items were borrowed from a number of sources (Davis, et al., 1989; Kim, 2008; Pavlou, 2001) and wording was modified to fit with LBS context. For example, '*Using a smartphone in my job would enable me to accomplish tasks more quickly*' (Kim, 2008) was modified to '*Using LBS in my job would enable me to accomplish tasks more quickly.*'

4.1.6 Trust

The trust measure consisted of three dimensions: ability, benevolence and integrity (Mayer, et al., 1995). Trust items came from three sources (Pavlou, 2003; Pavlou & Gefen, 2004; Sillence, Briggs, Harris, & Fishwick, 2007), based on the three

dimensions identified. Items were amended to fit in with LBS use, for example '*I feel that my employer is a knowledgeable source regarding LBS*'. For each trust item the question was asked twice, once referring to 'my employer' and once to 'the LBS provider'. This was to determine if trust of the person's employer (in most cases known to them) differed from trust of an LBS provider (potentially unknown).

4.1.7 Perceived risk

Risk items were borrowed from a measurement tool devised to assess trust and privacy risk in LBS use (Xu, Teo, & Tan, 2005). The items focused on risk involved with information disclosure, such as '*There would be too much uncertainty associated with giving my personal information to Company A*.' Items were amended for this questionnaire, for example '*There would be too much uncertainty associated with divulging my location information.'*

4.1.8 Intention to use LBS

Junglas & Spitzmüller (2005) did not recommend items for the measurement of intention, therefore items came from various scales (Pavlou, 2001; Spitzmüller & Stanton, 2006; Xu, et al., 2005). Some items focused on the acceptance of an LBS system ('If my company implements an LBS system, I will accept this and try not to avoid it'). Other items were purposefully created to predict intention in the workplace, such as 'I intend to use a device which would allow people to locate me during working hours.' A summary of all the items and their origins can be seen in Table 4.1.

4.1.9 Response scale

Aside from the EPQ-R scale which was a yes/no response, a 7-point Likert scale was used to measure responses. The Likert scale was devised to solve the problem of measuring social attitudes. Attitude towards an object or statement is measured using response categories that generally range from 1 (strongly agree) to 7 (strongly disagree) (Likert, 1932). This attempt to equalise attitude intervals has become a common method in psychological research. Empirical research has shown that data from 5-point, 7-point and 10-point items show very similar characteristics in terms of mean, variance, skewness and kurtosis (Dawes, 2008). The 7-point scale was used in this questionnaire to allow participants to report 'neither agree nor disagree.'

Table 4.1 Summary of Questionnaire item origins

LBS model item	Question origins
Technology Characteristics	Questionnaire information sheet
Task Characteristics	Devised according to LBS type (Location-tracking)
Personality items	
Locus of Control	Lauder (1993) based on Rotter (1966)
Conscientiousness	TIPI (Gosling, Rentfrow, & Swann, 2003)
Neuroticism	EPQ-R Short Scale (Eysenck & Eysenck, 1991)
Openness to Experience	TIPI (Gosling, Rentfrow, & Swann, 2003)
Perceived privacy	Smith, Milberg, & Burke (1996), Stone, Gardner, Gueutal & McClure (1983), Pavlou (2001)
Perceived Usefulness	Davis, Bagozzi and Warshaw (1989), Kim (2008), Pavlou (2001)
Trust	Sillence, Briggs, Harris, & Fishwick (2007), Pavlou (2003), Pavlou & Gefen (2004)
Perceived Risk	Xu, Teo, & Tan (2005)
Intentions to Use LBS	Spitzmüller & Stanton (2006), Xu, Teo, & Tan (2005), Pavlou (2001)

4.2 Pilot study

The items summarised in Table 4.1 were refined over a 2 month period. If statements came from previous research then the exact wording was used wherever possible. Previous research has cited limitations with the amendment of existing scales (Malhotra, et al., 2004). However, some measurements did need amendment to be applicable to an LBS context, such as Smith et al's (1996) privacy concern scale (Iachello & Hong, 2007). This method of amending scales has been utilised in other research developing LBS frameworks (Pura, 2005). It was anticipated that after the pilot questionnaire, items could be significantly reduced or amended (see Appendix 11.1 for the pilot questionnaire).

4.3 Ethics

All six studies reported in this thesis (in chapters 4 - 9) adhered to Northumbria University ethics guidelines. All studies were submitted to, and passed by the university ethics committee. Wherever possible, participants were given a hard-copy information sheet, consent form, and debrief sheet for each study.

In studies where postal or electronic data collection was utilised, participants were also given information about the study, a consent form, and instructions on how to withdraw. For the postal questionnaire reported in chapter 4, consent forms were included as part of the questionnaire, signed, and returned by post. For the online questionnaire reported in study 5, consent statements were included which had to be read and accepted by participants before the questionnaire could be completed.

4.3.1 Participants

Research in this field often uses students when piloting new technologies (Junglas, et al., 2008), but the aim of this thesis was to assess the intentions to use LBS with more appropriate populations. The pilot study was used as an opportunity to disseminate the questionnaire to people unfamiliar with an LBS system, but who were employed, and for whom LBS technology could potentially be useful. Two groups of people were involved in the pilot study. A local housing association was identified, and a paper version of the questionnaire (using items described above) was distributed to them over a 2 week period. Participants were asked to complete the questionnaire in full, and were given an open response box to leave feedback. In total 22 employees filled in the questionnaire, 7 male and 15 female. Their ages ranged between 18–65 years old. Also, a number of Trackaphone customers familiar with LBS were asked to complete the questionnaire. In total 9 completed questionnaires were returned, from 5 males and 4 females. Their ages ranged between 26–65 years old. The aim of the pilot was not to accumulate large amounts of data but to establish if the questionnaire had face validity, was readable, and could be completed successfully.

4.3.2 Questionnaire feedback

The qualitative feedback received was useful to enable refinement of the questionnaire. The main comments about the questionnaire related to its length, with participants recommending it was reduced in order to be manageable and quicker to complete. Some questions were highlighted as not reading well, and some words were said to be difficult to understand, such as ‘circumvent’. Below are some examples of the feedback.

- It would help on the scales to provide reference points as to what is meant by 1-7
- Question 95 has no 'yes/no' option
- I don't understand what 'conventional' is in question 35
- There are lots of questions! Maybe shorten some sections down
- The opening paragraph is very dense
- I feel some of the questions are irrelevant to the use of LBS
- The questions seem repetitive
- I felt 2/3rds of the questionnaire was obtaining a psychological breakdown of me which is irrelevant to what I felt the questionnaire was intended
- It would give me peace of mind when lone working
- It's not just a matter of safety- it could result in unwanted spying

4.4 Modifying the questionnaire

In order to facilitate participant understanding and in accordance with the feedback, a number of issues were addressed. It was decided that some questionnaire items were unnecessary, and a simpler questionnaire could be used whilst still retaining the model constructs. These changes are summarised below.

4.4.1 Task characteristics

The task characteristics questions remained the same, but in an effort to reduce the length of the questionnaire and make it more concise, questions such as '*I would find LBS acceptable if a friend could locate me at any time*' were removed. This is because questions relating to people outside a work environment were irrelevant.

4.4.2 Personality

Some participants commented that the questions relating to personality were intrusive, and they did not know why they were included. To try and alleviate concerns about the personality measures, a brief explanation of why the questions were there was included: '*Research has shown the type of person you are will affect how receptive you are to technology uptake. People with different personality types may have different attitudes towards LBS use.*' This approach has been recommended when dealing with sensitive issues (Malhotra & Birks, 2006).

It was decided that the EPQ-R was too long, and participants also felt it was invasive. The neuroticism measure was amended to a shorter scale- the International Personality Item Pool (IPIP, 2009). This was a ten-item scale specifically designed to measure neuroticism.

4.4.3 Perceived privacy

The privacy items were unchanged and came from Smith, Milberg, & Burke's (1996) scale. The items from Stone et al. (1983) were removed as they were not recommended by Junglas & Spitzmüller.

4.4.4 Perceived usefulness

Perceived usefulness items were reduced, and came from one source recommended by Junglas & Spitzmüller (Davis, et al., 1989).

4.4.5 Trust

Trust items were also reduced, and came solely from one scale (Pavlou, 2003). The other items removed were not recommended by Junglas & Spitzmüller, and did not

contribute to a pre-existing scale, unlike Pavlou. The wording of the questions was changed slightly and didn't include the precursor '*I feel that.*'

4.4.6 Perceived risk

The risk questions, although they remained similar in wording, were taken from a scale developed to measure online privacy and trust issues (Pavlou & Gefen, 2004). These items were amended to reflect LBS use, for example '*My decision to participate in LBS use is risky*.'

4.4.7 Intention

The pilot intention items were taken from other scales, but didn't specifically relate to LBS use. For this reason, new items were created for the main questionnaire, but were based on the format used in other intention-style questions (Luarn & Lin, 2005; Vijayasarathy, 2004).

Using the feedback from the pilot study, a new questionnaire was designed. A summary of the item origins can be seen in Table 4.2 (the full questionnaire can be seen in Appendix 11.3).

Table 4.2 Revised questionnaire items

LBS model item	Question origins
Technology Characteristic	Location-tracking information sheet
Task Characteristics	Developed by researchers
Personality items	
Locus of Control	Lauder (1993) based on Rotter (1966)
Conscientiousness	TIPI (Gosling, et al., 2003)
Neuroticism	IPIP (2009)
Openness	TIPI (Gosling, et al., 2003)
Perceived privacy	Smith, Milberg, & Burke (1996)
Perceived Usefulness	Davis, Bagozzi and Warshaw (1989)
Trust	Pavlou (2003)
Perceived Risk	Pavlou & Gefen (2004)
Intentions to Use LBS	Developed by researchers, based on Luarn & Lin (2005) and Vijayasarathy (2004)

4.5 Method

4.5.1 Materials

The revised questionnaire was printed on A4 paper, along with a cover letter to participants explaining the study. An ethics page was also included on the front of the questionnaire to ensure consent was gained. This sheet had to be signed by each participant before their data was used (see Appendix 11.2 and 11.3 for the cover letter and questionnaire). Participants were offered a chance for overall feedback on the study if they provided their e-mail address. They were also entered into a prize draw to win high street vouchers if they completed and sent back their questionnaire on time. Participants were asked to return the questionnaire within four weeks.

4.5.2 Participants

Participant details were obtained with the use of a marketing company who provided the names and addresses of 1,500 people working in the UK. A month after the questionnaire was sent out, 106 completed questionnaires had been returned by post. Participants consisted of 60 male and 44 female participants, with 2 omitting demographic information. Almost half of all participants were aged 25-44 (53%). The next largest group was those aged 20-24 (35%). The ages of 16-19 and 60+ years accounted for 1% and 9% of the sample respectively. A summary of other demographic information and reported LBS use collected in the questionnaire can be seen in Table 4.3, 4.4 and 4.5.

Table 4.3 Ethnic origin of participants

Ethnicity	
White (British)	95%
White (Other)	4%
Other	1%

Table 4.4 Employment information of participants

Employment status	
Full-time paid employment	82%
Part-time paid employment	5%
Self-employed	13%
Employment sector	
Accountancy/Banking/Business Services	32%
Advertising/Marketing/PR	5%
Construction/Engineering/ Agriculture	4%
Education	3%
Government/Public Sector	5%
Health/Social Care	5%
HR/IT/Legal Services	23%
Manufacturing	1%
Media/Publishing	4%
Tourism/Hospitality/Retail	2%
Transport/Logistics	3%
Other	15%

Table 4.5 Self-reported frequency of LBS use at work

Use of LBS at work	
Yes	5%
No	95%
LBS use frequency	
Not at all	95%
Less than once per week	1%
2-3 times per week	1%
About once a day	1%
More than once a day	1%

4.6 Results

All data was entered into SPSS v.18 and screened for normality. Reliability analysis was conducted, with Cronbach's alpha for each construct as follows: task characteristics (.931), locus of control (.805), conscientiousness (.562), neuroticism (.805), openness to experience (.417), perceived privacy (.816), perceived usefulness (.922), trust (.688), perceived risk (.834), and intentions to use LBS (.854). Low values of Cronbach's alpha for both conscientiousness and openness to experience may be due to each construct consisting of only two items. Data for a number of questions were reverse scored to ensure consistency, with a higher score reflecting a positive value (see Appendix 11.3 for details).

Likert scores which were unclear (a response between two points) were removed before analysis, along with partially completed data sets. From the initial 106, the number of participants in the final factor analysis was 97.

4.6.1 Factor analysis

Factor analysis was implemented to see if the constructs that were being measured in the questionnaire would be identified in the data set. The adequacy of the sample size

was confirmed by both the Kaiser–Mayer–Olkin test of sampling adequacy and Bartlett's test of sphericity. The first was .658, which is considered a satisfactory value (Kaiser, 1974), and the second was also statistically significant ($x2 = 3413.716$, $df=1326$, $p<.001$). Loadings greater than 0.35 were considered to be significant.

The analysis was run applying the principal-axis factoring method with Varimax rotation. Interpreting the output, 21 factors were identified from the data. Exploring these factors, it was decided that the questions relating to 'locus of control' should be removed as they did not fit well with the identified factors, and some questions held low loadings. This process of eliminating items was conducted with consideration of question item content and loading values. As the locus of control items were dispersed evenly throughout the factor analysis, it was not deemed a stable construct to include in further analysis. Items from the TIPI were also removed from analysis (Gosling, et al., 2003) which included extraversion, agreeableness and emotional stability. These items did not feature in the specified model originally suggested by Junglas & Spitzmüller, and were deemed unnecessary to include in further analysis (SPSS output can be seen in Appendix 11.4).

A second factor analysis then identified 14 factors. Eleven of these factors related to concepts from the Junglas & Spitzmüller model. These were *task characteristics, collection of information (privacy), neuroticism, perceived usefulness, unauthorised secondary use of information (privacy), intentions to use LBS, trust of the employer, perceived risk, errors in collection of information (privacy), trust of the LBS provider,* and *conscientiousness*. The remaining 3 factors consisted of items with low loadings, for example a number of neuroticism items which also loaded more highly onto the neuroticism factor identified above, and privacy items. Again, the content of

these items did not fit together coherently, and were removed from further analysis. A final analysis was conducted to verify the constructs already identified, without the final three factors, as described.

From the final factor analysis, only 10 of the 11 factors were meaningful. The ten factors identified were labelled as *Intentions to use LBS, Disclosure to employer, Neuroticism, Employer responsibility, Perceived Usefulness, Out of work tracking, Trust of the employer, Trust of the LBS provider, Perceived Risk and Conscientiousness* (see Table 4.6). The main difference between the second and third factor analysis was the division of privacy items, which were subsequently renamed as *disclosure to employer* and *employer responsibility.* The eleventh factor consisted of one *neuroticism* and one *openness to experience* item, and was therefore disregarded (SPSS output can be found in Appendix 11.5).

Table 4.6 Varimax rotated principal component analysis identifying 10 factors

Q	Item	Factor loadings									
		1	2	3	4	5	6	7	8	9	10
76	Allow employer to locate me during work hours	.767									
71	Use LBS to be located during working hours	.792									
70	LBS would help if I was working alone	.803									
74	LBS would help if working in unknown area	.817									
77	LBS would help if working in a dangerous area	.818									
72	LBS would help if a great distance from work	.861									
44	Concerned employer will collect location info		.787								
45	Not comfortable employer is able to track at any time		.793								
46	Rather not provide location information to employer		.831								
42	Bothers me when location info is available to employer		.848								
41	Bothers me if employer stores location info		.850								
11	I rarely get irritated			.486							
6	I am not easily bothered by things			.542							
7	I feel comfortable with myself			.578							
5	I dislike myself			.581							
8	I have frequent mood swings			.665							
18	I am often down in the dumps			.673							
2	I often feel blue			.712							
12	I panic easily			.712							
16	I seldom feel blue			.832							
57	Databases should be protected from unauthorised access				.441						
59	Employer should ensure unauthorised people cannot access location info				.553						
49	Employer should ensure location info in databases is accurate				.596						

50	My employer should have procedures to correct errors in location information				.613						
53	My employer should not use my location information unless authorised by me				.657						
54	My employer should never sell location information of employees to other companies				.679						
52	My employer should never share location information without my consent				.702						
56	My employer should devote time and effort to preventing unauthorised access to location information				.727						
51	My employer should not disclose location information to unauthorised parties				.765						
64	I would find LBS useful at work					.740					
60	Using LBS would improve my performance at work					.834					
61	Using LBS at work would increase my productivity					.855					
63	Using LBS would enhance my effectiveness at work					.889					
69	Use it to be located travelling to/from work						.564				
75	Use LBS to allow employer to locate travel to/from work						.613				
73	Use LBS to be located outside working hours						.763				
78	Would use LBS to allow employer to locate outside working hours						.796				
62	Trust my employer has my best interests in mind							.740			
55	My employer keeps promises and commitments							.808			
43	My employer is trustworthy							.810			
65	Considerable risk involved in participating in LBS use								.656		
68	My decision to participate in LBS use is risky								.678		
67	High potential for loss involved in participating in LBS use								.767		
66	Trust LBS provider would have my best interests in mind									.664	
58	The LBS provider would keep promises and commitments									.715	
48	The LBS provider would be trustworthy									.763	
1	I see myself as dependable, self-disciplined										.733
3	I see myself as disorganised, careless										.733

Considering the Junglas & Spitzmüller model, 7 out of the 10 factors were constructs which had already been identified and labelled (intention, neuroticism, perceived usefulness, trust (divided into trust of LBS provider and trust of employer), perceived risk and conscientiousness). The remaining factors (disclosure to employer, employer responsibility, and out of work tracking) were re-named as new factors. A summary of the ten factors can be seen in Table 4.7.

Table 4.7 Factor analysis results

Factor number	Factor name
1	Intentions to use LBS
2	Disclosure to employer
3	Neuroticism
4	Employer responsibility
5	Perceived Usefulness
6	Out of work tracking
7	Trust of the employer
8	Trust of the LBS provider
9	Perceived Risk
10	Conscientiousness

4.6.2 Regression

From the factor analysis, step-wise logistical regression analysis was used to develop a model to predict intentions to use LBS from the factors identified. The 'out of work tracking' factor was removed from analysis, as the focus was LBS use during work hours. Basic descriptive statistics and regression coefficients are shown in Table 4.8. A model of the regression results can be seen in Figure 4.2.

A regression analysis showed that perceived usefulness ($p < .001$), trust of the LBS provider ($p < .05$), and disclosure to employer ($p < .05$) had significant correlations

with intentions to use LBS. The R^2 value was .33, thus the three predictor model was able to account for 33% of the variance in intentions to use LBS, F (3,99) = 16.31, p<0.001. Using the R^2 value of .33, based on 8 predictors in the regression and participant size (N=97), post hoc power analysis identified an effect size of $f^2 = 0.49$. Following conventional guidelines about sample size adequacy (Cohen, 1988), this figure represents a large effect size.

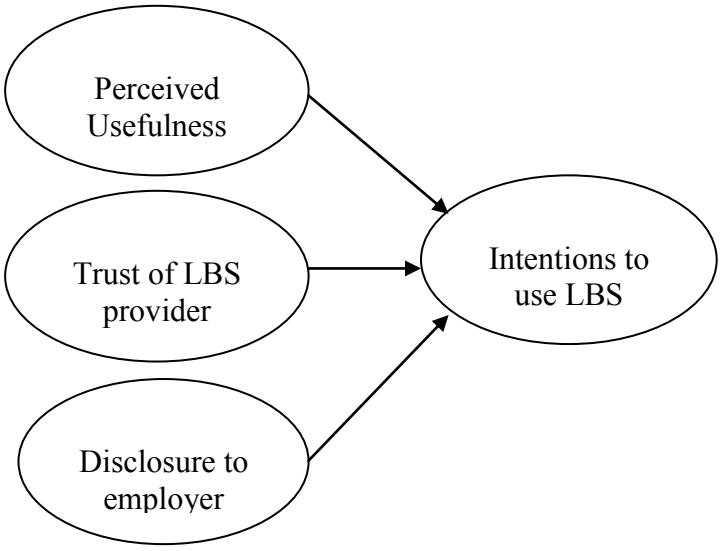


Figure 4.2 Regression results model

Looking at the beta weights in this regression, it can be concluded that the more the LBS system is perceived as useful by an individual, the more they intend to use it. Similarly, the more trust a person has in the LBS provider, the greater their intentions are to use LBS. Disclosure to employer is negatively related to the predicted variable of intention: this suggests that the more concerned people are about employer information management (disclosure to employer), the less likely they will intend to use LBS systems.

Table 4.8 Intentions to use LBS predicted by Disclosure to employer, Perceived Usefulness and Trust of the LBS provider

Zero order correlations							
	Perceived usefulness	Trust LBS provider	Disclosure to employer	Intention	β	B	SE B
Perceived usefulness		.171*	-.220*	.455**	.360	.397	.094**
Trust of LBS provider			-.106	.345**	.258	.340	.110*
Disclosure to employer				-.337**	-.231	-.236	.086 *
					Intercept:	.873	.747
Mean	4.93	3.33	4.46	2.91			
SD	1.43	1.19	1.54	1.57		R^2 =	.331*
					**p < .001		*p < .05

4.7 Discussion

The aim of this study was to develop a questionnaire in order to test a theoretical model to predict intentions to use LBS, based on personality, perceptual and situational attributes. The analysis conducted on this data has provided an insight into what influences decision-making when thinking about LBS use.

Factor analysis revealed that 10 constructs were present in the data. Some of the factors do support the Junglas & Spitzmüller model. In particular, the factors of usefulness, trust, and risk emerged distinctly. However, the personality item locus of control did not emerge as a significant predictor of intention to use LBS. Looking at the scale used to measure locus of control, it may be the case that the questions relate to a more general feeling of control in life, rather than a feeling of control related to LBS use. As explored in chapter 2, issues of control are considered important for users of LBS, and the items may benefit from a focus on more specific LBS control issues.

Importantly, issues of privacy did emerge, but not as the expected seperate factors relating to the four areas of location information suggested by Junglas & Spitzmüller. The privacy items were distinguished as two seperate factors, one which was renamed *discolsure to employer*, and the other renamed as *employer responsibility*. The disclosure to employer factor included items relating to the employer storing or revealing employee location information. Employer responsibility items focused on privacy aspects surrounding the employers duties to protect an employees' location information. Both of these factors accounted for the majority of the privacy items in the questionnaire. One other unexpected factor identified was out of work tracking.

These questions came from the intention to use LBS scale, but were grouped based on their content relating to LBS use outside of the workplace.

The regression analysis took the nine predictor variables from the factor analysis, and aimed to see if they accounted for the predicted variable, intentions to use LBS. The regression showed that perceived usefulness, trust of LBS provider and disclosure to employer accounted for 33% of the variance in intentions to use LBS.

The regression provides some support for the proposed model by Junglas & Spitzmüller, but also shows that some measures are not necessarily important when predicting LBS use. It is not unexpected that perceived usefulness was a major predictor of intentions to use LBS. However, perceived risk which was hypothesised to be inseparable from trust did not appear as a predictor for intention. The risk items used phrases which in hindsight may have been too vague, which may explain why they did not impact on intentions.

It is interesting that 'trust of the LBS provider' is considered important when predicting intentions to use LBS. A number of questions related to LBS in the workplace, and issues of employer responsibility, rather than an LBS provider. It can only be assumed that participants felt more knowledgeable about their employer's privacy policies; however the idea of an LBS provider may seem unknown to participants.

4.8 Chapter summary

Analysis of the questionnaire has suggested that the model devised by Junglas & Spitzmüller can not necessarily account for intentions to use LBS, as some of their items were not identified, or existing measures such as privacy were categorised

differently. A regression identified that issues of usefulness, trust and disclosure in the workplace could account for intentions, yet this model did not account for a necessarily large proportion of intentions.

Using items identified in the analysis of this questionnaire, a second questionnaire was designed and deployed to a larger sample. The aim of this secondary questionnaire was to refine the constructs in order to create a new and improved model to predict intentions to use LBS. This study is discussed in chapter 5.

CHAPTER 5: REVISING THE JUNGLAS & SPITZMÜLLER MODEL

Chapter 4 highlighted that the model identified by Junglas & Spitzmüller (2005) to predict intentions to use LBS needed revision. Personality constructs, perceived risk measures and some privacy concepts were not identified as predictive of intention to use LBS. Analysis *did* show, however, that concepts of perceived usefulness, trust of the LBS provider, and disclosure to employer influenced intentions to use LBS. The items used in the original questionnaire were modified to create a new questionnaire, with the aim of improving the LBS model. The questionnaire reported in this chapter also includes a section relating to use of LBS via social networking sites (SNS), a concept described in Chapter 1. This chapter will describe the approach taken to revise the questionnaire, report the results from this new questionnaire, and explain the social networking site findings.

5.1 Introduction

Chapter 3 described a research model in which *personality traits, task characteristics, technology characteristics, perceived privacy, trust, perceived risk* and *perceived usefulness* were suggested as predictive of intentions to use LBS (Junglas & Spitzmüller, 2005). This model can be seen in Figure 5.1. The researchers who designed this model also suggested validated measurement items which could be used to assess each construct.

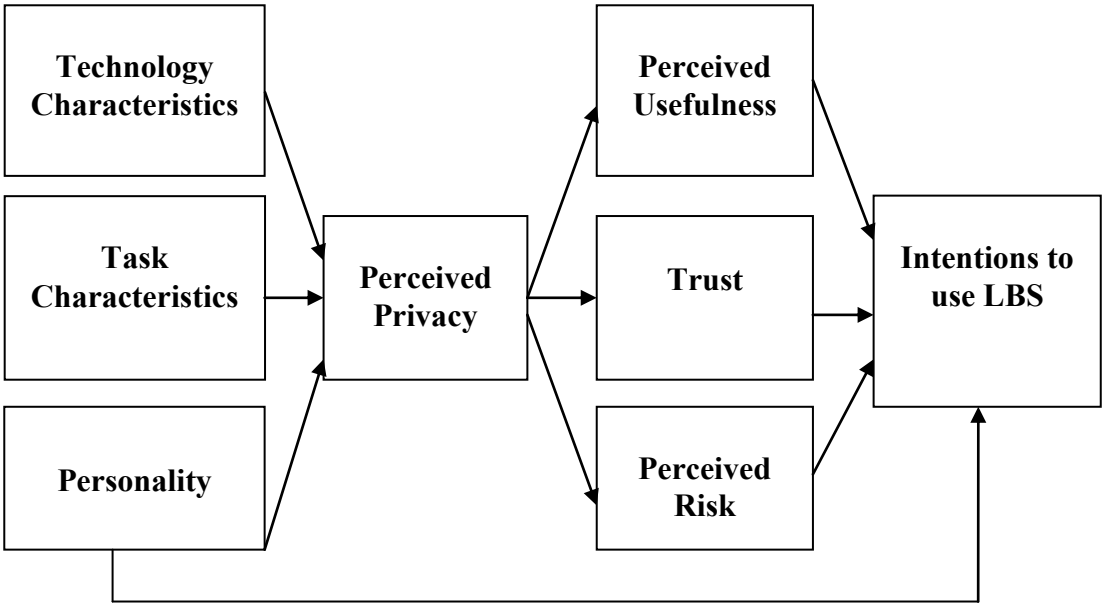


Figure 5.1 The Junglas and Spitzmüller LBS model

This is the most comprehensive, yet untested model to predict intentions to use LBS described in the literature to date. In order to assess this model and fill a gap in the literature, the model was tested using a questionnaire (described in chapter 4). The questionnaire included items for each of the constructs identified in the model, and the items were taken from scales recommended by Junglas and Spitzmüller wherever possible. This questionnaire was distributed by post to employees in the UK.

Results from the questionnaire analysis suggested 10 factors were present in the data: *intentions to use LBS, disclosure to employer, neuroticism, employer responsibility, perceived usefulness, out of work tracking, trust of the employer, trust of the LBS provider, perceived risk* and *conscientiousness*. A stepwise regression was conducted to see if these factors could predict intentions to use LBS. The regression analysis showed that perceived usefulness, trust of LBS provider, and disclosure to employer were the main predictors of intentions to use LBS (Figure 5.2).

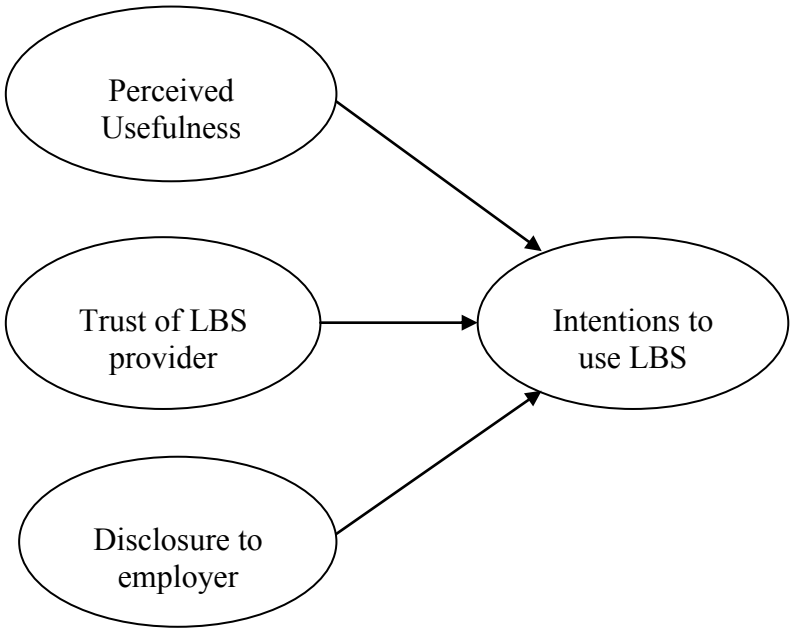


Figure 5.2 Regression results from the initial questionnaire

5.1.1 Rationale for revision

The results summarised above suggest there are clear differences between the model suggested by Junglas and Spitzmüller, and the predictive model which has been identified here. For example, personality measures were not found to be predictive of intention to use LBS, despite Junglas and Spitzmüller identifying conscientiousness, neuroticism, locus of control and openess to experience in their model. Privacy concepts were identified, but not in the anticipated structure suggested by Junglas & Spitzmüller. The results suggested privacy to be two seperate factors, one renamed as *discolsure to employer*, and the other *employer responsibility,* to reflect the items they represented. Trust was identified as being two factors, seperating out 'trust of the employer' from 'trust of the LBS provider'.

For these reasons, a new questionnaire was developed which focused on the items which *were* found to be predictive of intentions. In order to determine if factors other than the 10 identified in the factor analysis should be included in the new model, an additional exploratory regression was carried out with *all* factors identified, which included the 'out of work tracking' factor. This factor was purposely omitted from the main regression because the study aim was to focus on LBS use *during* work hours. However, this second regression revealed 'trust of employer' as another factor which predicted intention to use LBS. As this 'trust of employer' factor was part of the overall original trust component, it was added to the new model to be tested.

Figure 5.3 outlines the revised model to predict intentions to use LBS, based on the results described in chapter 4. This model which included the concepts of perceived usefulness, trust of the LBS provider, disclosure to employer, trust of employer and intentions to use LBS was used to structure the new questionnaire.

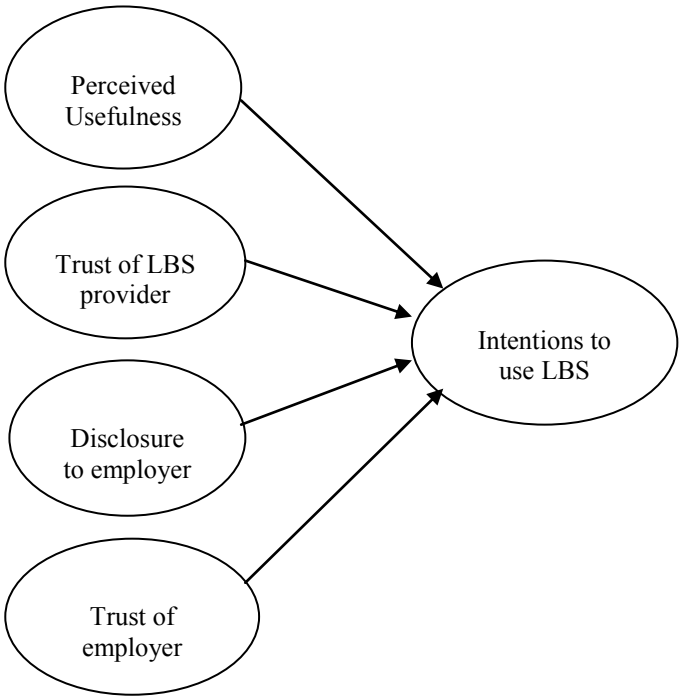


Figure 5.3 The revised LBS model

As well as testing a new model to predict intentions to use LBS, the questionnaire was designed to include exploratory questions relating to LBS use via social networking sites (SNS). This chapter will be divided into two sections, the first focusing on the results of the revised questionnaire and predictive model, and the second exploring results from the social networking site questions.

5.2 Method

5.2.1 Revised items

A revised 'intentions to use LBS' questionnaire was developed to assess the new model. This questionnaire included 23 items relating to intentions to use LBS at work, and 6 demographic questions. All questions were included with the same wording as in the previous questionnaire. The key difference between this and the initial Junglas and Spitzmüller questionnaire was the number of items included. Questions pertaining to perceived risk and personality were omitted, along with a number of privacy items. The questionnaire was greatly reduced in size as only factors which were identified in the regression analysis were included: *perceived usefulness, trust of the LBS provider, disclosure to employer, trust of employer and intentions to use LBS.* This questionnaire was created online, in order to distribute it quickly (for more detail, see 5.2.2).

Each section of the questionnaire was preceded by a short paragraph explaining the set of questions. For example, before the perceived usefulness items, the information read: *'We would now like to ask you about the acceptability of using LBS in the workplace, and more specifically, when you think a tracking system would be useful.'* All questions used a 7-point Likert scale as before. The first page of the

questionnaire provided information explaining to participants the purpose of the study and what LBS were. An ethics page was also included at the start of the questionnaire, and participants could only complete the remainder of the questionnaire if they agreed to the ethics statements (see Appendix 11.6). This compulsory format was applied throughout the questionnaire, eliminating the problem of missing data.

5.2.2 Procedure

In order to improve efficiency and distribute to a larger sample, the questionnaire was created using a survey builder with an online survey distributor (Zoomerang, 2011). The questionnaire was sent electronically to participants on behalf of the survey distributor. The sample requirements were the same as the first questionnaire, with the aim of specifically recruiting only people in employment. The sample included US as well as UK participants. As LBS are already prominent in the US, it was expected that there may be different perceptions of use. The two samples provided an opportunity to explore these potential differences. The questionnaire was 'live' for two weeks, achieving 500 UK and 500 US responses. The online survey automatically closed when the quota for each population was reached. G*power indicated that with 5 factors and only a small effect size of .80, the sample size would need to be 600. Considering this, 1000 responses was deemed appropriate.

5.2.3 Participants

In total 979 usable questionnaires were collected, with 471 US and 508 UK responses. There were 476 male and 502 female participants (49% and 51% respectively). Almost half of all participants were aged 25-44 (47%). The next

largest group was those aged 45-59 (26%). The ages of 16-19, 20-24 and 60+ years accounted for 3%, 9% and 15% of the sample respectively. A summary of other demographic information collected in the questionnaire can be seen in Table 5.1, 5.2, and 5.3 (note, the question recording frequency of LBS use at work was not compulsory to answer, resulting in a varied response rate).

Table 5.1 Ethnic origin of participants

Ethnicity	
White (British)	50%
White (Other)	37%
Black/African American	4%
Chinese	1%
Indian	1%
Pakistani	1%
Bangladeshi	<1%
Asian	1%
Caribbean	1%
African	1%
American Indian/Alaska Native	<1%
Hawaiian	<1%
Other	3%

Table 5.2 Employment information of participants

Employment status	
Full-time paid employment	49%
Part-time paid employment	18%
Self-employed	12%
Voluntary employment	21%
Employment sector	
Accountancy/Banking/Business Services	7%
Advertising/Marketing/PR	1%
Charity Work	6%
Construction/Engineering/ Agriculture	6%
Education	11%
Government/Public Sector	7%
Health/Social Care	9%
HR/IT/Legal Services	4%
Manufacturing	5%
Media/Publishing	2%
Tourism/Hospitality/Retail	8%
Transport/Logistics	3%
Other	30%

Table 5.3 Self-reported frequency of LBS use at work

Use of LBS at work	
Yes	7%
No	73%
Don't know	20%
LBS use frequency	
Not at all	24%
Less than once per week	1%
About once per week	2%
2-3 times per week	4%
4-6 times per week	1%
About once a day	1%
More than once a day	2%

A sample of retired participant data was also obtained in error (n=70). The occupation parameters were initially set incorrectly by the survey provider, but were rectified. These participants were not included in this analysis, but were incorporated into the social networking site analysis described in the second part of this chapter. The reason this population was not used in the analysis was due to the employment focus of the questionnaire.

5.3 Results

All data was recorded electronically, downloaded from the online questionnaire, and uploaded to SPSS v.18. Reliability analysis was conducted with Cronbach's alpha for each construct as follows: disclosure to employer (.950), trust of employer (.930), trust of LBS provider (.931), perceived usefulness (.965), and intentions to use LBS (.927). Data was screened for normality prior to analysis. The data for all 5 disclosure to employer questions (11-15) were reverse scored to ensure consistency, with a higher score reflecting a positive value.

5.3.1 Factor analysis

Factor analysis was conducted to see if the constructs identified in the new model would be identified in the data set. The analysis was run applying the principal-axis factoring method with Varimax rotation. The adequacy of the sample size (n=979) was confirmed by both the Kaiser–Mayer–Olkin test of sampling adequacy and Bartlett's test of sphericity. The first measure was .903, which is considered a satisfactory value (Kaiser, 1974), and the second was also statistically significant ($x^2 = 22412.96$, df=210, $p<.001$). Loadings greater than 0.35 were considered to be significant.

From the combined analysis of the UK and US sample, factor analysis suggested that all 5 factors thought to be predictors of intention were present in the data (see Table 5.4). These factors were *perceived usefulness, trust of LBS provider, disclosure to employer, trust of employer and intention to use LBS* (SPSS output can be found in Appendix 11.7). Importantly, when conducting a separate factor analysis on the UK and US populations, these 5 factors were also clearly identified.

Table 5.4 Varimax rotated principal component analysis of UK and US data, identifying 5 factors

Factor label	Item no.	Question	1	2	3	4	5
Disclosure to employer	11	Bothers me if employer stores my location information	.898				
	12	Bothers me if location info is available to employer	.927				
	13	Concerned employer will collect too much location info	.914				
	14	Not comfortable employer is able to track me at any time	.851				
	15	Would rather not provide my location information to employer	.881				
Trust of employer	16	My employer is trustworthy				.914	
	17	Trust my employer has my best interests in mind				.891	
	18	Employer is known as one that keeps promises & commitments				.894	
Trust of LBS provider	19	LBS provider would be trustworthy					.875
	20	LBS provider would keep promises and commitments					.890
	21	Trust the LBS provider would have my best interests in mind					.834
Perceived usefulness	22	LBS would improve my performance at work			.915		
	23	LBS at work would increase my productivity			.926		
	24	Using LBS would enhance my effectiveness at work			.923		
	25	I would find LBS useful at work			.824		
Intentions to use LBS	26	I would use LBS if I was working alone		.741			
	27	Would use LBS if somewhere a distance from my workplace		.850			
	28	I would use LBS if I was working in an unknown area		.912			
	29	I would use LBS if I was working in a dangerous area		.880			
	30	I would use LBS to be located during working hours		.723	.352		
	31	Would use LBS to allow employer to locate me in working hours		.645			

5.3.2 Regression

Step-wise logistical regression analysis was then used to assess the identified factors, and see what would predict intentions to use LBS. Basic descriptive statistics and regression coefficients are shown in Table 5.5. Perceived usefulness ($p < .001$), Trust of LBS provider ($p < .001$), Disclosure to Employer ($p < .05$) and Trust of Employer ($p < .05$) had significant correlations with Intentions to use LBS. The four predictor model was able to account for 38% of the variance in intentions to use LBS, F (4, 974) = 148.69, p<0.001.

Looking at the beta weights in this regression, it can be concluded that the more the LBS system is perceived as useful by the individual, the more they intend to use it. Similarly, the more trust a person has in the LBS provider and their employer, the greater their intentions are to use LBS. The more concerned people are about employer information management (disclosure to employer), the lower their intentions are to use LBS. These results confirm the findings from the regression reported in chapter 4.

The UK and US data were analysed together, and the regression reported is based on these two samples. However, it is important to note that when carrying out separate regressions the factors differed depending on country (see Table 5.6). Assessing the UK sample only, the predictive factors were perceived usefulness ($p < .001$), trust of LBS provider ($p < .001$), and trust of employer ($p < .05$). When analysing the US sample, the predictive factors were perceived usefulness ($p < .001$), trust of LBS provider ($p < .001$), and disclosure to employer ($p < .05$).

Table 5.5 Intentions to use LBS predicted by Disclosure to employer, Perceived Usefulness, Trust of the LBS provider and Trust of the employer (N = 979)

Zero order correlations								
	Perceived usefulness	Trust LBS provider	Disclosure to employer	Trust of employer	Intention	β	B	SE B
Perceived usefulness		.434**	.271**	.261**	.531**	.367	.343	.027**
Trust of LBS provider			.256**	.397**	.497**	.297	.344	.035**
Disclosure to employer				.308**	.269**	.077	.066	.023*
Trust of employer					.293**	.056	.055	.028*
						Intercept:	1.42	.152
Mean	3.36	4.26	3.34	4.66	4.51			
SD	1.49	1.20	1.62	1.41	1.39		R^2	.379**
						**p < .001		*p < .05

Table 5.6 Regression analysis results by country

UK & US	UK	US
Perceived usefulness	Perceived usefulness	Perceived usefulness
Trust of LBS provider	Trust of LBS provider	Trust of LBS provider
Disclosure to employer	Trust of employer	Disclosure to employer
Trust of employer		

5.3.3 Structural Equation Modelling

In chapter 4, the aim of designing the questionnaire was to assess the Junglas & Spitzmüller model, and see whether the model items would predict intentions to use LBS. As decribed in the previous chapter, results revealed flaws in their model, therefore a revised model was designed. In *this* chapter, the aim was to test the new model to predict intentions to use LBS.

Testing this new model, regression analysis confirmed there were four factors which accounted for the variance in predicting intentions to use LBS. The next stage in this analysis was to see if these constructs could be mapped using Structural Equation Modelling (SEM). SEM provides a way of modelling the structural relationships between factors (or variables) using path and factor-analysis. A hypothesised model can be tested statistically in a simultaneous analysis of the entire system of variables to assess its fit to the data (Robson, 2002). If the model displays a significant result, this means the data is different to the model structure. A non-significant result

suggests there is little difference between the data and the model structure, and the model is deemed a good fit. The items identified in the regression were drawn as a model to predict intentions to use LBS (Figure 5.4). The model was drawn in Amos Graphics v.18, and the data from the revised questionnaire was applied.

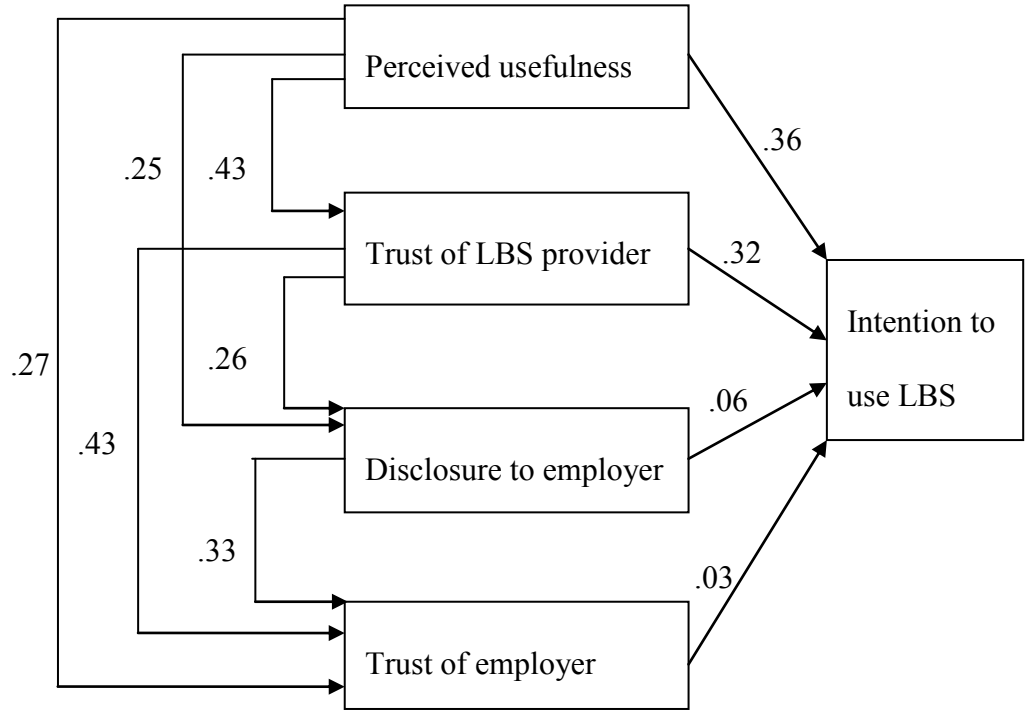


Figure 5.4 SEM results displaying new model to predict intentions to use LBS

The model reported is the one amended after consulting modification indices. If requested, AMOS can suggest improvements to the model in order to better the fit. Modification indices recommended the addition of a covariance between two sets of intention to use LBS items. This modification was made after consulting item wording, as it became clear that the questions were similar in content, and therefore justified theoretically as well as statistically.

The final SEM model suggested by principal components analysis yielded fit indices of .963 (CFI and IFI), .910 (GFI) and RMSEA of .069, indicating a good fit. The χ^2 value for the model, with 177 degrees of freedom, was 1003.955 (p<.001). Full AMOS output can be seen in Appendix 11.8.

Looking solely at the χ^2 value, it would suggest that the model is not a good fit to the data. However, it has been noted that χ^2 tends to increase with sample size (Kline, 2005). In cases where the sample size is large, even small model-data discrepancies are said to result in a significant χ^2 value. In this case, exploring the other diagnostic model information is more indicative of model fit. The values of GFI, CFI and RMSEA indicate the model is a good fit to the data. The standardised path weights should also be noted, as they suggest the ways that the constructs might interact (see Table 5.7).

Table 5.7 Path weights between constructs in SEM analysis

Factor	**Path weight**
Perceived Usefulness - Intentions	*.36*
Trust LBS provider - Intentions	*.32*
Disclosure to Employer - Intentions	*.06*
Trust of Employer - Intentions	*.03*
Perceived Usefulness - Trust LBS provider	*.43*
Perceived Usefulness - Disclosure to Employer	*.25*
Perceived Usefulness - Trust of Employer	*.27*
Trust LBS provider - Disclosure to Employer	*.26*
Trust LBS provider - Trust of Employer	*.43*
Disclosure to Employer - Trust of Employer	*.33*

The path weight scores between perceived usefulness and intentions, and trust of LBS provider and intentions are high. In comparison, the scores for disclosure to employer and trust of employer with intentions are much lower. The relatively low scores between these factors are understandable, as they were also less predictive in the regression analysis.

If the paths between perceived usefulness and trust of LBS provider are removed, and the analysis is conducted again, disclosure to employer and trust of employer path weight scores improve. This suggests that they are perhaps measuring similar things to the first two factors, or not particularly adding anything more to the model. Nevertheless, this SEM analysis supports the regression results, and confirms that perceived usefulness and trust of LBS provider are major considerations when predicting intentions to use LBS.

5.4 Social Networking Sites

In addition to the LBS at work questions, a second section within the new questionnaire explored the use of LBS using social networking sites. This was an exploratory extension of the main questionnaire, with questions referring specifically to social networking sites which have the capacity to collate and store location information with friends and family. Whilst this alternate media is different to the use of LBS in a workplace scenario tested earlier on, the inclusion of this approach here is warranted as it forms part of the overall attempt to devise a useable measurement tool to enable prediction of intentions to use LBS, regardless of technology format.

Social networking sites (SNS) are a way for people to interact with others online. They allow people to create a profile, post information and photographs on their profile page, talk to other users, and add them as friends. Some sites have included the ability to add location information to posts, with users being able to 'tag' themselves into a place (see Chapter 1 for more information). Depending on privacy settings, someone can also allow themselves to be tagged into a location by others (see Figure 5.5). The use of SNS such as Facebook, Twitter, LinkedIn and MySpace has gained in momentum. In 2008, these sites had 60 million US users (Skeels & Grudin, 2009), and this figure will undoubtedly grow.

Figure 5.5 Facebook with 'check in' capabilities

5.4.1 Why explore SNS?

Offline there is no record of our social activities; yet with this increased online interaction, the process of recording information may become more important for users of SNS. The use of SNS has also permeated the workplace, as users connect with friends and family (Skeels & Grudin, 2009). This has contributed to concerns

about security and employee productivity. Most importantly, Skeels & Grudin revealed that users of SNS are concerned about who might see their information. Research has also shown that participants would not want information on their Facebook profiles to be disclosed to current or potential employers (Peluchette & Karl, 2008). However, managing private information has been viewed by participants as time consuming and difficult (Gross & Acquisti, 2005). A reluctance to engage in privacy restrictions online leads to the question of whether SNS encourage people to disclose more than they would necessarily like to.

With LBS integrations into SNS being a relatively new phenomenon, exploration of attitudes towards this practise has been limited. However, the increased interest in this area is reflected in the numerous articles exploring issues of privacy and sharing via SNS (Acquisti & Gross, 2006; Dwyer, Hiltz, & Passerini, 2007; Guha, Tang, & Francis, 2008; Joinson, 2008; Lewis, Kaufman, & Christakis, 2008; Schrammel, et al., 2009). Researchers also acknowledge that privacy and trust in SNS settings need to be investigated further, as SNS behaviour is yet to be successfully defined (Dwyer, et al., 2007). The second part of the questionnaire attempted to explore issues of SNS to see if factors considered important in LBS use at work could be applied to this new way of communicating.

5.5 Method

Thirteen questions relating to LBS via SNS usage were included in the questionnaire. The questions about SNS followed on from the main LBS section, and mirrored the type of questions asked in that section. There were three types of SNS question, relating to disclosure to SNS, trust of SNS, and intentions to use LBS (via SNS). The questions were modified to fit the new context, for example the ‘disclosure to

employer' questions used in the first part of the questionnaire were revised to read: *'It bothers me if social networking sites store my location information.'* The intention questions asked about intention to share location with friends, family, and employer using SNS. An information page was also included which explained to participants what a SNS was and how it might be used in terms of location tracking. The inclusion of these questions was a cursory attempt at exploring the potential factors relevant to LBS via SNS use, while utilising the LBS model as a guiding principle.

5.5.1 Participants

Participants included the original UK and US data set, as well as the retired participants who erroneously completed the survey. This group was included as the responses for the SNS questions did not require participants to be employed. In total, 1049 participants were included in the SNS data analysis. The demographics for the sample remained the same as reported in the first part of the questionnaire. The addition of 70 retired adults comprised of 38 males, 32 females, with 86% specifying they were aged 60 or over, 95% identifying as white, and the remaining 5% were African or Asian. The frequency of participant's reported LBS use via a SNS can be seen in Table 5.8.

Table 5.8 Self-reported LBS use via SNS

Use of LBS via SNS	
Yes	14%
No	86%

5.6 Results

Data was screened for normality prior to analysis. Reliability analysis was conducted with Cronbach's alpha for each construct as follows: disclosure to SNS (.939), trust of SNS (.930), and intentions to use SNS (.870).

5.6.1 Factor analysis

A factor analysis was conducted to see if the constructs identified in the questionnaire would be identified in the data set. The adequacy of the sample size was confirmed by both the Kaiser–Mayer–Olkin test of sampling adequacy and Bartlett's test of sphericity. The first was .896, which is considered a satisfactory value (Kaiser, 1974), and the second was also statistically significant ($x2 = 10481.48$, $df=55$, $p<.001$). Loadings greater than 0.35 were considered to be significant. Using a varimax rotated factor analysis, three factors were identified (Table 5.9). Full SPSS output can be found in Appendix 11.7. The three factors identified were disclosure to SNS, trust of SNS, and intentions to use LBS (via SNS).

Table 5.9 Factor analysis results for SNS data identifying 3 factors

Factor label	Item	Question	1	2	3
Disclosure to SNS	34	It bothers me if SNSs store my location information	.883		
	35	It bothers me if my location information from a SNS is available to friends & family	.777		
	36	I'm concerned that SNSs will collect too much location information about me	.899		
	37	I'm not comfortable with the idea that SNSs are able to track me at any time	.881		
	38	I would rather not provide my location information to SNSs	.851		
Trust of SNS	39	SNSs are trustworthy		.876	
	40	I trust that SNSs have my best interests in mind		.870	
	41	SNSs are known to keep promises and commitments		.892	
Intentions to use LBS	42	I would use SNSs to share my location information with friends			.828
	43	I would use SNSs to share my location information with family			.894
	44	I would use SNSs to share my location information with my employer			.675

5.6.2 Regression

A regression was carried out using enter method, which involves all predictive factors being considered in the model; the two factors of disclosure to SNS and trust of SNS were included as the predictors of intentions to use LBS (via SNS). This type of regression was used rather than the previous step-wise method due to the smaller number of predictive factors. Using this method can tell which, if any of the predictor variables contribute significantly to the model. Basic descriptive statistics and regression coefficients are shown in Table 5.10.

Whilst Structural Equation Modelling was utilised for analysis of the main part of the questionnaire, it was not considered worthwhile to use here, as no theoretical model is being proposed. Rather, this SNS assessment was designed to give a hint at the factors affecting LBS use when using different media.

Disclosure to SNS *(*$p < .001$) and trust of SNS ($p < .001$) had significant correlations with intentions to use LBS (via SNS). The two predictor model was able to account for 45% of the variance in intentions to use LBS via SNS: F (2, 1046) = 432.47, $p<0.001$. The results suggest that when deciding whether to use a SNS to divulge location information, trust of the SNS is important, as well as issues of information disclosure. Looking at the beta weight values in the regression table, the more trustworthy a SNS is perceived, the more likely someone is to intend to use it. Similarly, the less concern is felt regarding disclosure of location information to a SNS, the more likely someone intends to use it.

Table 5.10 Intentions to use LBS predicted by disclosure to SNS and trust of SNS

Zero order correlations						
	Disclosure to SNS	Trust of SNS	Intention	β	B	SE B
Disclosure to SNS		.448**	.543**	.345	.383	.028**
Trust of SNS			.598**	.444	.507	.029**
				Intercept	.617	.096
Mean	2.62	3.17	3.23			(**p <.001)
SD	1.40	1.36	1.56		R^2 =	.453**

5.7 Discussion

5.7.1 A revised model

In terms of predicting intentions to use LBS, the studies reported in chapter 4 and here in chapter 5 have shown that the most recent theoretical model put forward by Junglas and Spitzmüller is not appropriate. In chapter 4, the analysis of a questionnaire designed to assess their exact model suggested that personality measures were not relevant to predict intentions to use LBS. Similarly, privacy items were not identified as expected, and trust items distinguished between the employer and LBS provider.

Based on these results, a new questionnaire was designed to reflect a new model, which has been reported in this chapter. The revision involved removal of questionnaire items mainly relating to personality, risk and certain privacy measures. This new model comprised of 5 factors: perceived usefulness, trust of LBS provider, disclosure to employer, trust of employer and intentions to use LBS. This new model was assessed using factor analysis, regression and structural equation modelling, all of which confirmed that perceived usefulness, trust of LBS provider, disclosure to employer and trust of employer were predictive of intentions to use LBS. These factors were incorporated into a new model which is now able to predict intentions to use LBS.

5.7.2 Influences on intentions to use LBS

Whilst perceived usefulness, trust of LBS provider, disclosure to employer and trust of employer were found to be predictive of intentions to use LBS, the factors had varying degrees of influence. There was a much larger contribution to intentions

from perceived usefulness and trust of the LBS provider. The importance of perceived usefulness is understandable, as the more useful a system is perceived, the more likely someone will intend to use it. The perceived usefulness questions focused on productivity and effectiveness at work, suggesting that as the applicability of LBS to the workplace increased, so did perceptions of usefulness and intentions to use the system.

However, the importance of trust of the LBS provider was an unexpected finding. The perceptions of an LBS provider are not something which has been explored in the literature in any detail. One explanation for this concern may be that knowledge of the LBS provider was limited. Exploring the demographic information, only 7% of participants reported using LBS in the workplace. Importantly, 73% reported not using the technology at work, and a further 20% did not know if an LBS system was in use at work (see Table 5.3 for more descriptive information). If people were not familiar with LBS or a provider of LBS, there may be increased trust issues surrounding them. If an individual does not know anything about an LBS provider, then trust is undoubtedly going to be compromised. Although still a predictive factor in the regression, the lesser importance of trust of employer and greater significance of trust in the LBS provider suggests more consideration is needed on this issue. Within industry, enhancing or explaining the user-provider relationship to the customer more effectively may improve perceptions of the service, in turn encouraging greater adoption of the technology.

In terms of differences between the two populations, the data showed that the final predictor of intentions to use LBS was different for the UK and US. Trust and disclosure were interchangeable, with the UK sample showing trust of employer as

the third predictor. However, for the US, the third predictor was disclosure to employer. This difference may simply reflect perceptions of the employer, with UK participants considering the general trustworthy nature of their employer more, whilst US participants may hold more concern about the role their employer plays in managing sensitive location information. Even slight differences like this indicate, however, that perceptions of LBS are not global and there is certainly more research needed to explore geographical differences.

5.8 Developing a new model

In order to assess whether the data was a good fit to the model, structural equation modelling (SEM) was used. Although the results of the SEM analysis were not conclusive in terms of a non-significant Chi squared value, the other measures of fit suggested the model to be acceptable. The stronger relationships between perceived usefulness, trust of LBS provider and intentions also support the findings from the regression analysis. The two questionnaire studies reported in chapter 4 and 5 have added significantly to the academic literature, in that they have revealed an existing theoretical model to be insufficient to predict intentions to use LBS, resulting in a revised model and assessment tool.

This research is the first of its kind to identify factors which determine intentions to use LBS in the workplace, based on analysis of data collected with a relevant population, and can form the basis for other predictive models of LBS use in different contexts. The resulting questionnaire devised from the theoretical model is a useful tool not only for academia, but for industry. Whilst research in this area often focuses on the usability of various LBS prototypes, the results from the

questionnaire studies in chapters 4 and 5 provide a usable tool which can be applied to various LBS manifestations.

Despite this major contribution however, the revised model accounted for 38% of the variance in intentions to use LBS. This suggests there may be other influences on people's decision to use LBS which were not assessed with the questionnaire. The following qualitative chapters will attempt to explain what other factors may be important for people when considering LBS use.

5.9 Predicting intentions to use SNS

The exploratory study of SNS use in relation to LBS revealed that disclosure to SNS and trust of SNS were two important predictors of intention to use LBS in this context. These results show that a person's concerns about collection and storage of location information using SNS will impact on their intentions to use SNS. Similarly, trust of the SNS has shown to influence intentions to use them. These findings reveal that despite the development of social networking sites, issues of trust and control of information still inform decisions to use the technology. These findings also show that although the use of SNS may be growing, users are concerned about aspects of location tracking. This study was conducted as an opportunity to explore these issues, and the results provide a good foundation for further research into the area of SNS.

5.10 Chapter summary

The research approach described in this chapter has verified that aspects of the theoretical model proposed by Junglas & Spitzmüller may not be relevant to LBS adoption. This process of revising their model has clearly identified a new theoretical

framework to account for intentions to use LBS. This new model suggests that issues of usefulness, trust, and privacy concerns regarding personal information collection all contribute to intentions to use LBS. This study also found that when using a different media to access LBS, issues of trust and information disclosure are still important.

Despite these clear predictors of intention emerging from quantitative analysis however, there may be other important issues to consider regarding adoption of LBS technology. For this reason, chapters 6, 7, 8 and 9 explore different ways to understand more about user perceptions of LBS. The next chapter focuses on issues of disclosure: namely what types of location information might be disclosed, who the different recipients of that location information might be, and specifically how people categorise location information.

CHAPTER 6: DISCLOSURE

Knowing what kind of information people are willing to disclose, and who they would disclose it to is crucial to the success of LBS. Differing individual privacy preferences may influence the way an LBS system is used, or even determine if it is used at all. As explored in Chapter 2, research has shown that people are receptive to controlling their own disclosure preferences. The ability to predict or enable personalised disclosure preferences would facilitate technology to accommodate the individual. The aim of the work in this chapter is to understand these disclosure preferences. Three main questions are considered:

1. What diverse types of location information might be disclosed by people?
2. Who are the different recipients of these location disclosures?
3. How do people categorise these location disclosures into meaningful clusters?

This chapter reports the research in two phases. The first phase aims to answer questions one and two by utilising a concept elicitation exercise and exploring participant disclosure preferences. The second phase aims to answer question 3 by using multidimensional scaling to reveal clusters or patterns of location information.

6.1 Why is disclosure important?

The act of disclosure describes the manner in which people reveal personal information to others. This area of research is becoming integral to the design of technologies such as LBS, as the information they use is often of a delicate nature. The method we use to communicate information may affect the amount we disclose. Research has shown that the use of Computer Mediated Communication (CMC) leads to higher instances of non-task based self-disclosure, compared with face to

face discussions (Joinson, 2001). In this experiment the type of information disclosed by participants was unrelated to their task, and included statements such as 'I am a psychology student' or 'I also take anti-depressants' (Joinson, 2001, p. 31). In this study the type of information disclosed was not considered sensitive, and was volunteered by participants without probing. These findings suggest that computer-mediated communication enables participants to feel more at ease, potentially protected by the lack of face to face contact. A similar phenomenon can be observed in online chat rooms and support forums where people disclose detailed personal information to strangers (Barak & Gluck-Ofri, 2007).

6.2 Disclosing sensitive information

Although online communication methods may encourage more information sharing, people are generally still cautious about disclosing sensitive information. In one study highly sensitive questions such as 'How many sexual partners have you had?' were asked in an online forum which was monitored by researchers (Joinson, Paine, Buchanan, & Reips, 2008). Participants were given the opportunity to use an 'I prefer not to say' option, or blurring. Blurring involves disclosing information with greater ambiguity to protect sensitive information. More participants, and in particular males, would provide details of their income for example, using a blurring technique rather than saying outright 'I prefer not to say' (see Figure 6.1).

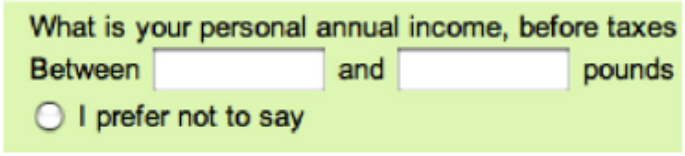


Figure 6.1 The Blurring Measure (Joinson et al., (2008)

It has been suggested that this kind of blurring disclosure is more socially desirable than saying nothing at all. Earlier work also suggests that context and pre-existing privacy concerns will determine levels of disclosure; we do not simply accept one privacy setting for all contexts, but wish to change these depending on the situation (Joinson, Paine, Reips, & Buchanan, 2006).

Knowing what *kind* of information people are willing to disclose is of great value, in particular to marketing companies and businesses. The ability to collect information can help target certain demographic groups and tailor marketing to their specific preferences. Using a mailing survey in the US, over 500 households gave information about what they would be happy to disclose to marketers (Phelps, et al., 2000). Unsurprisingly, people were more likely to disclose information about demographics and lifestyle, whereas financial information and personal identifiers were least likely to be revealed. Participants were also far more concerned about privacy than anticipated, and preferred more control over the 'gathering and dissemination' of their personal information (Phelps, et al., 2000, p. 27).

6.3 Disclosure using LBS

With the advent of social networking sites, including the rise in dating website usage (Smale, 2010), more disclosure research is being conducted to explore exactly what people are comfortable with sharing online. Similarly, research is beginning to consider disclosure preferences and information classification using LBS systems. As outlined in Chapter 2, research has suggested people have a desire to manage their disclosure preferences wherever possible. To date there is little research investigating the actual behaviour of genuine LBS users when their location is

requested, however there have been a number of prototype systems created to explore disclosure in the context of LBS.

The development and testing of 'Reno', one of the earliest location disclosure applications, has shown how privacy control and manual as well as automatic disclosure can be managed by the user (Smith et al., 2005). Specifically, the Reno system allows users to send and receive location information using a mobile phone (Figure 6.2). This system allowed participants to 'push' a location disclosure to someone, as well as request 'where are you?' with a subsequent, but not required location disclosure from that person. The users of this system defined the location names that would be used, for example 'school' or 'home' (Iachello, et al., 2005).

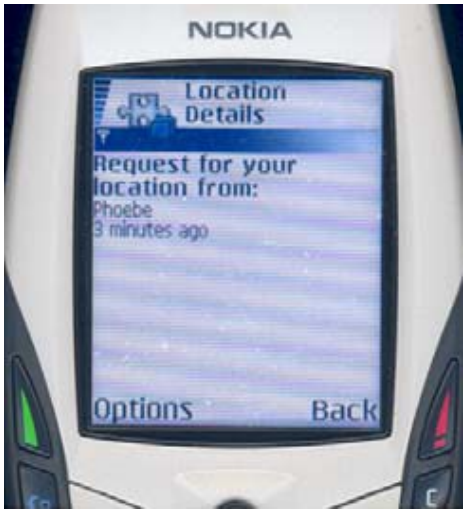


Figure 6.2 A screenshot of Reno, running on a Nokia 6600

Qualitative interviews with the users of the prototype system revealed *context* to be very important between the sender and receiver. Users were able to explicitly send their location information to others, knowing that the context of the information

would have meaning for them. For example, someone disclosing they were at an airport enabled the receiver to remember mutual friends were arriving that day. The pre-existing knowledge shared between the users also enabled short location labels to be interpreted correctly, as opposed to lengthy descriptors. This study also exemplified that automatic location disclosure was not always acceptable for the participants. Some disclosures were helpful, whereas others made participants feel uneasy. This study also supported earlier work which suggests the requester of information is most significant when deciding to disclose (Lederer, Mankoff, & Dey, 2003), but also that participants would rather disclose no information, than disclose something which is not useful to the requester. This purpose built locating tool showed that with context, close friends found the system useful. However, this study does not account for unexpected or unwanted disclosure, which may be a barrier to using LBS technology.

Although privacy concerns regarding information disclosure do exist, our ability to predict preferences for disclosure is sometimes contradictory (Connelly, Khalil, & Liu, 2009). In their study, Connelly et al. compared paper-based surveys with in-situ questions asked via a mobile PDA. Participants were asked about four disclosure contexts: *their location, their current activity, if they were talking, or if they were with others*. Results revealed a significant difference between self-reported disclosure permissions for survey and in-situ responses, with participants incorrectly predicting what they would be willing to share in the four contexts.

6.4 Sharing preferences

Previous research into disclosure preferences tends to focus on the receiver of information (Anthony, et al., 2009; Lederer, Mankoff, & Dey, 2003; Patil & Lai,

2005) rather than location information itself. One area of research that has attempted to look at the two issues has asked important questions such as '*what are people's concerns with sharing information?*' and '*what kinds of people and kinds of information do they treat similarly and differently?*' (Olson, Grudin, & Horvitz, 2005, p. 1985). Researchers recorded instances whereby people would not want to share information, for example, of one's pregnancy status. Participants also identified the type of person who may be given this information. Using a grid format, participants were asked to put a number in the grid to represent how comfortable they would be divulging information, with person type and information type being the grid axis. In addition to this, participants were also interviewed about privacy and sharing issues.

Cluster analysis was conducted, and overall ratings calculated. Cluster analysis suggested that types of people could be divided into public/competitor, co-workers, manager and trusted co-worker, family and spouse. Information categories included e-mail content, credit card number, income, phone numbers, age and marital status, health and work information. Ratings varied for information and person type, but the highest variance concerned personal information being shared with work colleagues. Overall, people's willingness to share information depends on who they are sharing with, rather than the information content (Olson, et al., 2005). This methodology is similar to that used in the study reported here.

6.5 Method

As described in the introduction, the aim of this study is to gain a better understanding of three aspects of location information disclosure:

1. What diverse types of location information might be disclosed by people?
2. Who are the different recipients of these location disclosures?
3. How do people categorise these location disclosures into meaningful clusters?

This work will be reported in two phases. Phase 1 aims to answer questions 1 and 2 by utilising a concept elicitation exercise and assessing recipient disclosure preferences. Phase 2 aims to answer question 3 by using multidimensional scaling to reveal cluster patterns of location information.

6.6 Phase 1

6.6.1 Procedure

Concept elicitation

In this study, each participant was given a verbal summary of the task they would be asked to complete, and offered the chance to ask questions. In order to find out what type of location information people might disclose, participants were asked to think of as many examples as they could of a location where they were carrying out an activity. Participants were given an example: *'I was going to visit a friend in hospital'* and then asked to generate further location ideas (see Appendix 11.10 for an example of the response sheet). This generating of ideas was required from the participant and is referred to as 'brainstorming' in the literature (Trochim & Kane, 2005).

Information disclosure preferences

In order to understand who the *recipients* of these location disclosures might be, participants were then asked who they would give their location information to (the locations they generated in the first part of this phase). Participants in this phase took part in both the concept elicitation and disclosure preference studies. Participants were asked to pick three cards (without looking), with each card displaying the name of one of a possible 18 types of person. These cards were created before the test, including *mother, father, partner/spouse, manager/boss, work colleague, doctor/nurse, bank manager, accountant, friend, brother/sister, private company, family member, stranger, teacher, neighbour, son/daughter, work friend,* and *employee*. These person types were used in line with similar work using labelling of groups (Olson, et al., 2005; Rashid & Woo, 2006), and peer reviewed by five academic members of psychology department staff before testing.

Participants were asked to think of the location examples they had generated, and who they would disclose this location to based on the cards they had picked. For example, if the participant picked 'mother', 'friend' and 'boss', and their location information was that they were 'in a bar', they might not want to disclose that information to their boss. This technique is similar to the idea of repertory grids, where the participant is asked to consider three types of information, and state which two are similar to each other, distinct from the third (Fransella, Bannister, & Bell, 2003). Participants were also asked to explain why they chose their disclosures on the response sheet.

6.6.2 Participants

A total of 59 adult participants were involved in phase 1. Participants consisted of 29 undergraduate students (4 male, 25 female), 13 postgraduate students (3 male, 10 female) and 17 academic members of staff (5 male, 12 female) from Northumbria University. Although age was not recorded, all participants were aged 18 or above. Students were recruited from the Psychology Department, but none were familiar with the task or research area. Undergraduate participants were recruited via the Psychology Department in-house recruitment website. They signed up for a 15-minute study, and were given participation points for their time. The postgraduate students completed the task during a lecture, with permission from the lecturer. Academic members of staff were recruited to take part via e-mail.

6.6.3 Materials

Participants were given a response sheet so they could write down their location/activity, who they would disclose this to, and why. Participants were also given access to a set of 18 laminated cards with the names of people on e.g. mother, work friend, doctor, in order to assist with the task.

6.6.4 Analysis

Disclosure grids were created to compare which people were being disclosed to. This involved adding up the number of 'yes' and 'no' disclosure responses from participants in phase 1. The *category* of location information being disclosed was also included in these grids. The methods used to assess these categories of location information are described in phase 2.

6.7 Phase 2

6.7.1 Procedure

In order to next understand how people *categorise* these location disclosures into meaningful clusters, the methodology of card sorting, or 'concept mapping' was used (Trochim, 1989). This method has been used in other studies focusing on information sharing preferences (Olson, et al., 2005).

During phase 1, 83 location types were identified by participants (a full list of the location types can be seen in Appendix 11.11). Each location that was identified was written on a card prior to phase 2, along with an identifying number (1-83). The locations that were generated in phase 1 covered a wide variety of situations. In order to decide what to include in phase 2, locations were not used when repetition occurred or if they were similar to another example provided by participants.

Participants were asked to group the 83 cards into piles according to similarity or 'likeness', however they felt the items clustered. This process allows participants to subjectively organise the data into as many piles as they feel necessary (Trochim & Kane, 2005). Participants were asked to group the cards, and leave them in their designated piles once satisfied with the sort. Once participants were finished, their groupings were recorded by writing down the numbers on the cards placed together.

6.7.2 Participants

In phase 2, a new group of undergraduate participants were recruited, again via the in-house participation website. Participants for the sorting exercise consisted of 37 undergraduate students (7 male, 30 female) from within the Psychology Department at Northumbria University. As before, age was not recorded but all participants were

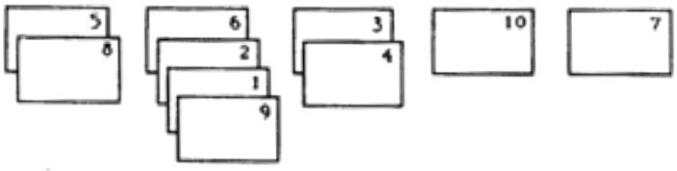
aged 18 or above. Around 10–20 participants has been suggested as a sufficient number for this methodology, but up to 80 can be used effectively (Trochim, 1989).

6.7.3 Materials

For the card sort task, participants were provided with 83 cards listing the statements about differing locations devised from the elicitation exercise in phase 1.

6.7.4 Analysis

Using the sorted piles, the groupings from each participant were put into a 'matrix', with 1 representing that the statement in that row and column were placed together in a pile, and a '0' indicating they were not (see Figure 6.3). This is known as a 'binary symmetric similarity matrix' (Trochim, 1989). This process is essentially a numerical representation of items that participants felt were like each other (in order to produce clusters of location information). These matrix numbers were entered into 37 Microsoft Excel spreadsheets, one for each participant.



Binary Square Symmetric Similarity Matrix

	1	2	3	4	5	6	7	8	9	10
1	1	1	0	0	0	1	0	0	1	0
2	1	1	0	0	0	1	0	0	1	0
3	0	0	1	1	0	0	0	0	0	0
4	0	0	1	1	0	0	0	0	0	0
5	0	0	0	0	1	0	0	1	0	0
6	1	1	0	0	0	1	0	0	1	0
7	0	0	0	0	0	0	1	0	0	0
8	0	0	0	0	1	0	0	1	0	0
9	1	1	0	0	0	1	0	0	1	0
10	0	0	0	0	0	0	0	0	0	1

Figure 6.3 Example of a card sort and similarity matrix (from Trochim, 1989).

The individual matrices were then summed to obtain a 'group similarity matrix'. The numbers in this matrix ranged from 0 to 37. To obtain a pictorial representation of the constructs, multidimensional scaling was used. This enabled the similar groupings made by participants to be displayed in clusters of 'relatedness'. These clusters are interpreted by looking at distance or proximity between the concepts (Kruskal & Wish, 1977). The only input the researcher had in terms of analysis was identifying these cluster groupings. This was based on the physical layout of location items which were displayed after statistical analysis. In summary, this methodology involved *concept elicitation* (location types suggested by participants) and their subsequent *concept mapping* (locations sorted into groups based on similarity or 'likeness'). This process enabled clusters of location information to be represented visually, based on grouping preferences of the participants.

6.8 Results

The results for both phase 1 and 2 are reported here, starting with the findings from the concept mapping task in phase 2. Phase 2 aimed to identify how people *categorise* location disclosures into meaningful clusters. These cluster results were then used to guide analysis of phase 1, which aimed to find out what type of location information might be disclosed, but importantly who the different recipients of this location information could be.

6.8.1 Results from Phase 2: Multidimensional scaling

Interpretation of the multidimensional scaling analysis suggested that people cluster location information into four main categories (Figure 6.4). These clusters were labelled as *family, social, formal social* and *medical*. It is important to note that relationships within a cluster are not always spatially relative from the first analysis. Item location in the overall analysis cluster may be quite arbitrary, and re-analysis of individual clusters has been recommended (Borgatti, 2007). Following this recommendation once each cluster was decided upon, multidimensional scaling was conducted again to explore each cluster in more depth (Figure 6.5, 6.6, 6.7 and 6.8).

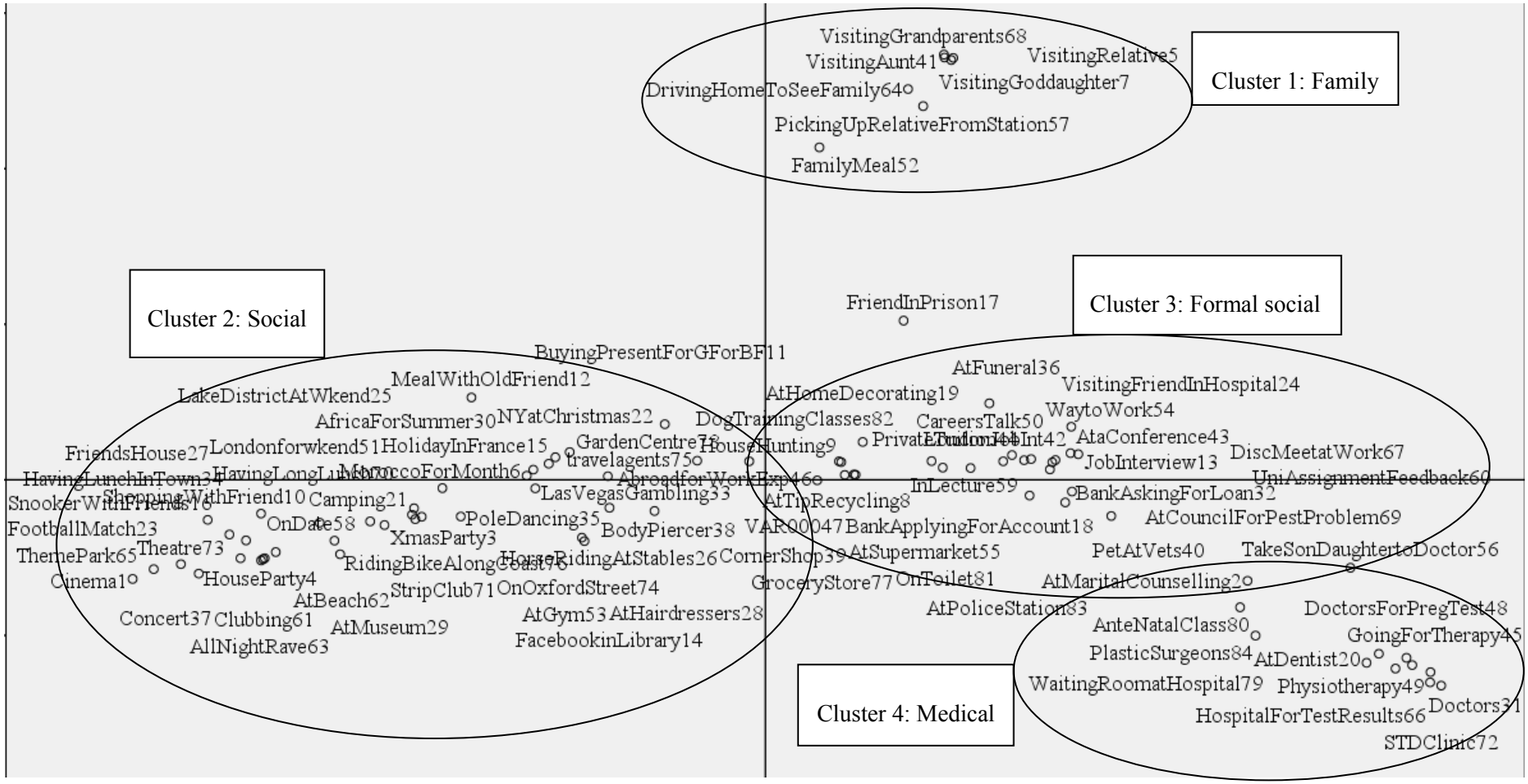


Figure 6.4 Overall cluster table from card sort data

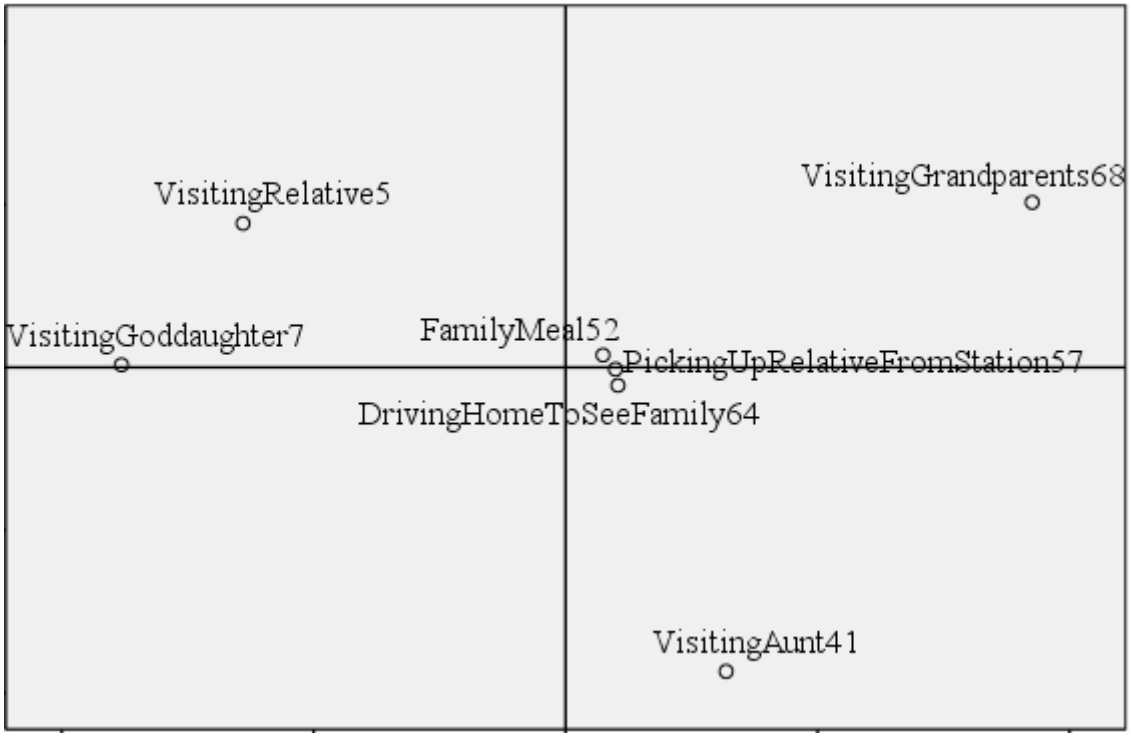


Figure 6.5 Cluster 1: Family

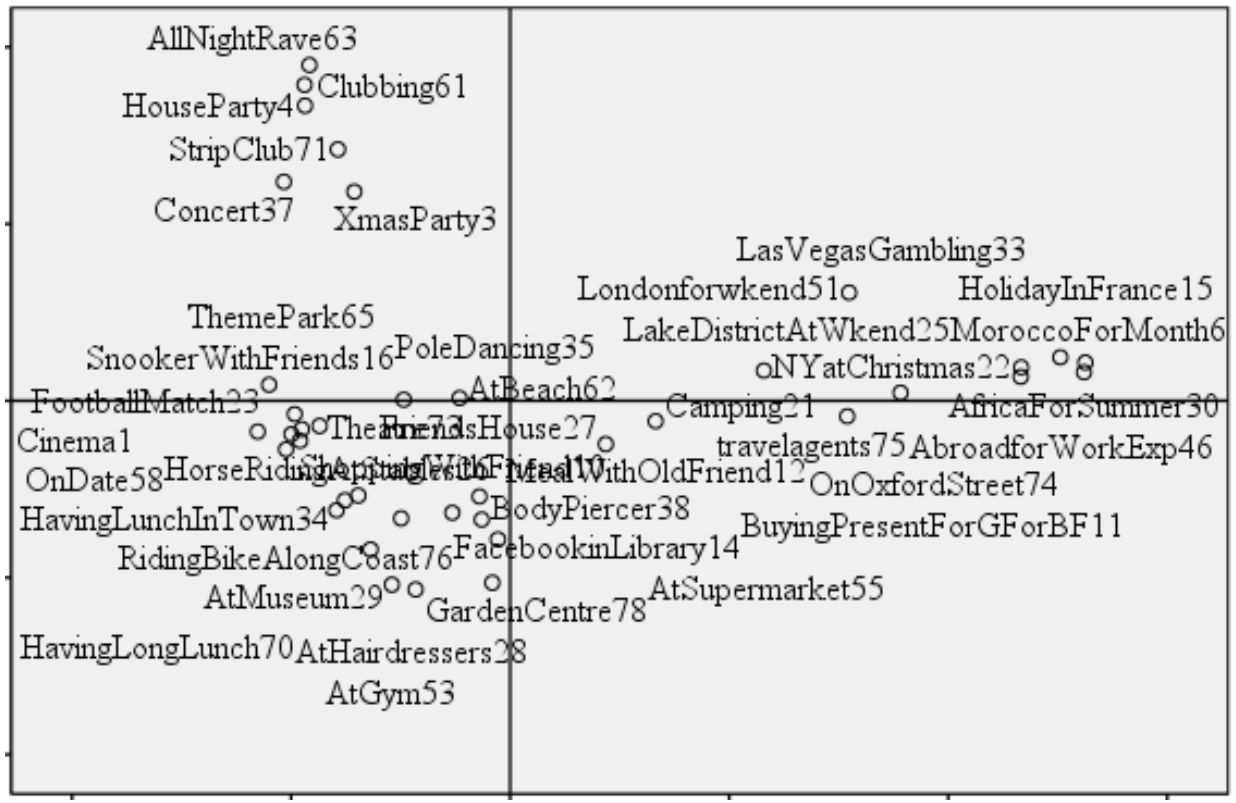


Figure 6.6 Cluster 2: Social

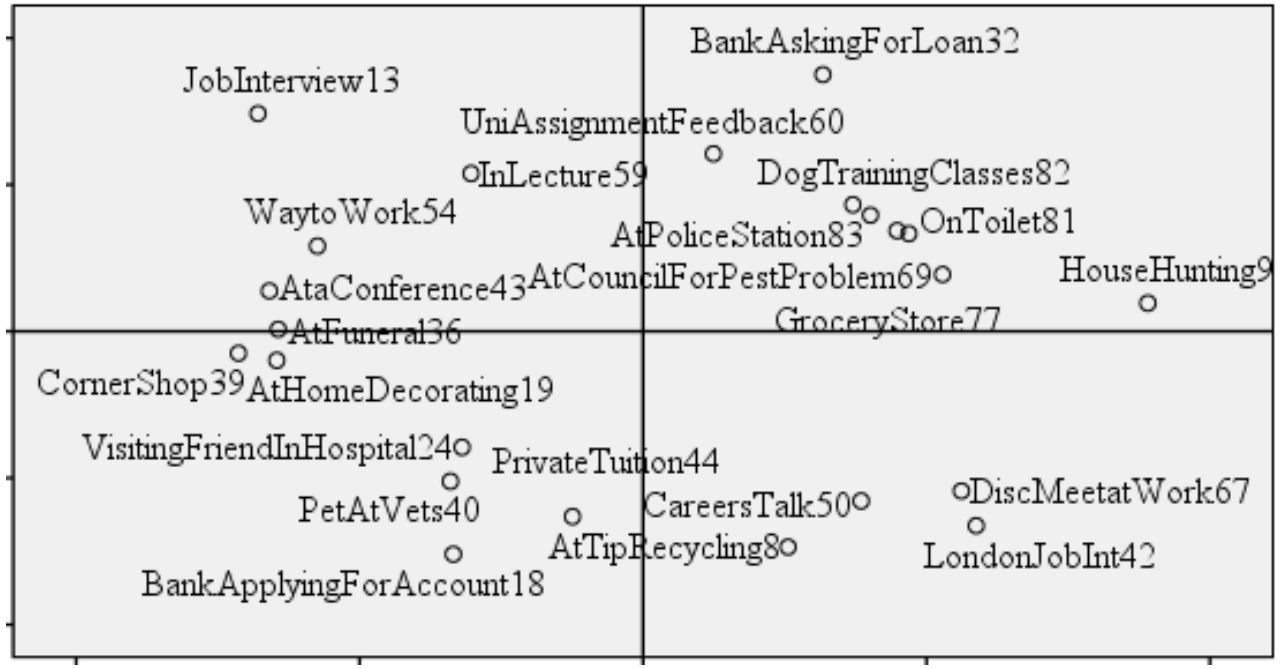


Figure 6.7 Cluster 3: Formal social

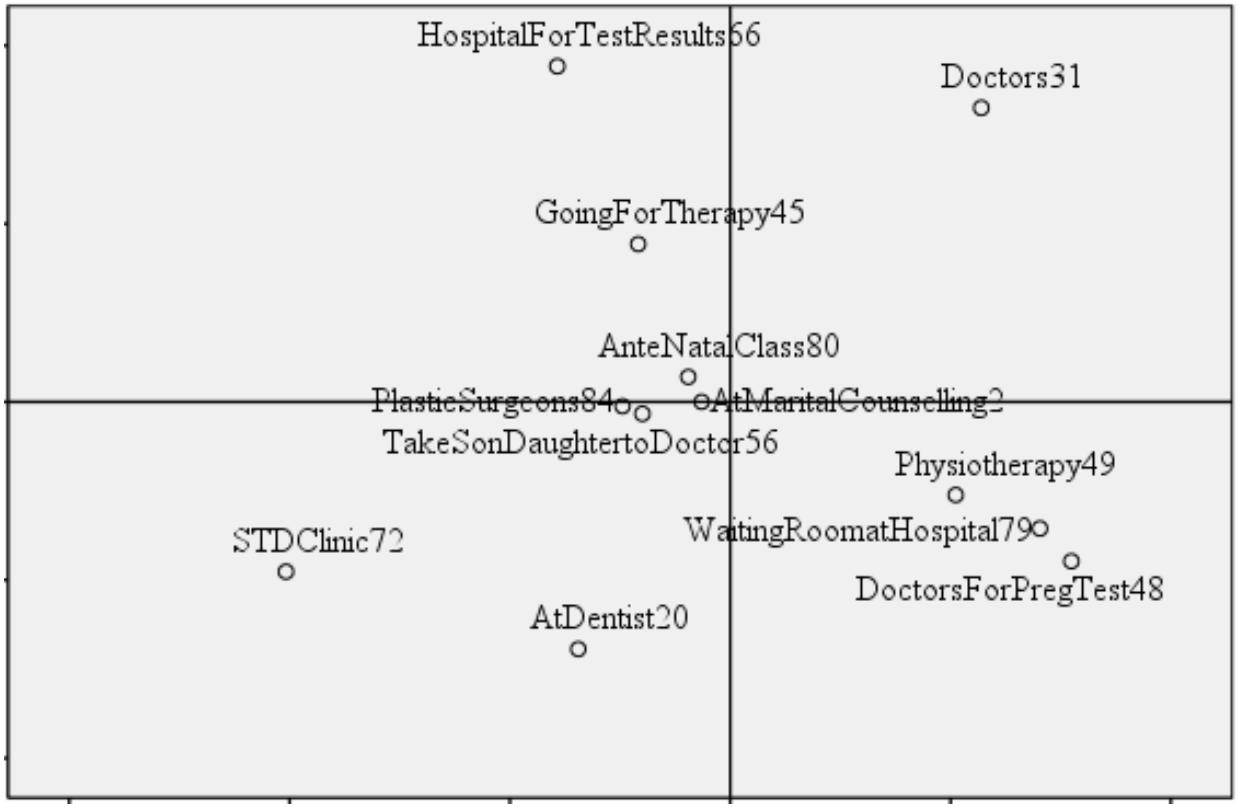


Figure 6.8 Cluster 4: Medical

The aim of phase 2 was to understand how people may cluster location disclosure information. The four clusters identified here suggest that people group information with consideration of their contextual similarities.

Cluster 1: Family

Family locations included 'visiting relatives' or 'having a family gathering'. Looking at Figure 6.5, the family cluster can be seen as quite separate from the other items. The re-analysis of the cluster did not suggest any spatial differences between items.

Cluster 2: Social

The differentiation between social and formal social clusters was subtle. In the social cluster, activities include 'shopping with friends', 'going to a garden centre', 'attending a concert', and 'at the supermarket'. The majority of activities and locations are casual and informal. They also seem more unambiguous than the 'formal social' items. However, looking at the cluster in more detail, Figure 6.6 shows that items such as 'clubbing', 'all night rave', 'house party' and 'strip club' are located away from these more informal activities, suggesting a different type of event. Some may perceive these as more secretive activities, which would explain their separation from the main cluster. There is also a small cluster of locations relating to being on holiday which grouped together.

Cluster 3: Formal Social

The formal social category includes activities or locations in which behaviour may be perceived as more structured, or consist of a familiar schema. For example, items clustered together include 'at a funeral', 'in a job interview', 'at the bank' and

'visiting council offices'. These events are much more ceremonial, formalised, and less sociable than the previous cluster activities.

Cluster 4: Medical

The medical cluster is small yet clearly defined as separate to the other items, with all locations having some sort of health reference. The cluster includes location types such as 'ante-natal classes' and 'physiotherapy', as well as items like 'STD clinic' or 'getting test results back'. Looking at Figure 6.8, despite a few outliers the items remain uniformly within the cluster.

6.8.2 Results from Phase 1: Disclosure grids

Disclosure grids were created to investigate results from phase 1 of the study, where participants were asked to specify who they would disclose location information to. Using the results from phase 2, location information type (the clusters described above) was assessed alongside person type. This was achieved by looking at the phase 1 response sheets to find yes/no disclosure responses, and by identifying which category the location information belonged to (family/social/formal social/medical).

Participants who said they *would* disclose location information to a particular person were given a score of +1. Participants who said they *would not* disclose that location information to a person were given a score of -1. The 18 person types were condensed to simplify analysis. For example, accountant and bank manager labels were merged into a 'finance' category. Two grids were produced, one for 'yes' and one for 'no' responses (see Table 6.1 and Table 6.2), which enabled clearer interpretation. Summing the yes and no responses simply resulted in scores cancelling each other out, with the final number not reflecting the results or holding

any real meaning. By separating out the yes and no disclosures, differences in preference could clearly be seen. A shaded cell depicts there was no response recorded for that person and location type. The tables show overall patterns, as not all combinations of person and activity were obtained.

Table 6.1 Number of 'yes' disclosure responses for the 4 types of information

	Finance: Accountant Bank manager	**Health:** Doctor/nurse	**Partner/spouse**	**Parents:** Mother Father	**Immediate family:** Brother/sister Son/daughter	**Extended family:** Family member	**Friend**	**Work:** Employee Manager/boss Teacher/lecturer	**Peers:** Work colleague Work friend	**Neighbour**	**Anonymous:** Stranger Private company
Family (cluster 1)	1	1	4	8	1	1	3	2	3		
Social (cluster 2)	5	4	10	18	17	6	5	10	16	7	3
Formal social (cluster 3)	2	2	6	11	8	3	6	7	5	2	1
Medical (cluster 4)		7	2	10	3	2	2	5	2	2	

6.8.3 'Yes' responses

Family information disclosure

The greatest number of 'yes' disclosures for family information were to parents. Parents and partners were more likely to be given location information, with participants reasoning that parents would most likely be attending the same event, or would be aiding them in their travel to the event. Friends and peers were next highest to be disclosed to about family locations. Aside from these instances, levels of disclosure for this cluster were generally low. Low 'immediate family' disclosures were explained by participants reasoning that there may be some distant family members they would not want at a family event.

Social information disclosure

Partners, parents, immediate family and work colleagues were most likely to be given information about social locations. Whilst high family and friend disclosure is to be expected, the high level of disclosure in the workplace category is not. However, a number of the participants in the study were students, who reasoned that they would be forced to disclose social obligations if they could not attend lectures. Similarly, other people said they would disclose location information such as 'going on holiday' to their employer for practical reasons. Participants said parents, and often their mothers would be given access to social location information because they already discussed most things with them.

Formal social information disclosure

Disclosure of formal social activities was predictably lower than social activities. Partners, parents, family, friends and work colleagues were disclosed to more than strangers, neighbours, medical or financial groups, which is not unexpected. However, there was only a small difference between disclosure to friends and peers compared with work people. Participants explained that a number of formal events they may attend would not be relevant to disclose to a doctor or nurse, but work would need to be notified if they were at a funeral, for example.

Medical information disclosure

Disclosure of medical location information was much lower than other information types. The people more likely to be given access to this information were parents and, logically, medical professionals. When deciding who to disclose to, participants reported that their parents would often go with them to important medical appointments. This increased medical disclosure to parents may also be due to the study sample, consisting of university students. They may be in a position where they need parental guidance for medical issues, or rely on them for transportation. Some of the location disclosures were to work colleagues, but people explained disclosure was because of a practical necessity rather than a preference.

In contrast, the number of 'no' responses can be seen in Table 6.2.

Table 6.2 Number of 'no' disclosure responses for the 4 types of information

	Finance: Accountant Bank manager	**Health:** Doctor/nurse	**Partner/spouse**	**Parents:** Mother Father	**Immediate family:** Brother/sister Son/daughter	**Extended family:** Family member	**Friend**	**Work:** Employee Manager/boss Teacher/lecturer	**Peers:** Work colleague Work friend	**Neighbour**	**Anonymous:** Stranger Private company
Family (cluster 1)	-4	-1				-2	-1	-1		-1	-2
Social (cluster 2)	-8	-7	-1	-4		-1		-16	-4	-4	-15
Formal social (cluster 3)	-6	-2			-2			-7	-1	-2	-8
Medical (cluster 4)	-2			-2	-3	-1	-1	-1	-1	-2	-3

6.8.4 'No' responses

Family information disclosure

The number of disclosure refusals for family locations was quite low. Most refusals were to financial, extended family and anonymous people. Some participants also explained refusals in terms of information necessity, rather than preference. For example, a lecturer would be given information because they would need to be informed about absence, but an uninvolved friend may not be told about the event.

Social information disclosure

Refusal to disclose social location was high. Work management and anonymous people were least likely to be disclosed to. Health professionals and financial people were also less likely to be given social information. Parents, peers and neighbours were also less likely to be disclosed to, with some activities not deemed relevant for them to know about. For example, one participant did not want to disclose to her mother that she was at a rave because she thought she would not approve.

Social information disclosure to employers/managers involved both high yes and high no responses. This was in part due to people agreeing to disclose information to them reluctantly. For example, when talking about a shopping trip, one participant said their bank manager might be given the information because they needed to borrow money from them. As described earlier, the disclosure to people in authority was not necessarily desirable, but was often described as a necessity.

Formal social information disclosure

With the prospect of being identified in more formal social locations, participants did not want to disclose to financial, work or anonymous people. A lot of reluctance to disclose to work groups was because items related to job interviews and looking for other forms of employment. There was a desire for secrecy when participants said they would be going to events or locations relating to new employment.

Medical information disclosure

Although the disclosure refusals for medical locations were low, they were evenly spread across the person types. Strangers and immediate family were least likely to be told about a medical-related location. One participant explained that she would not divulge medical information to a son/daughter as they would not want to worry them, while other participants said they would not disclose medical locations to strangers as it had nothing to do with them.

6.9 Discussion

6.9.1 Disclosure in context

This study aimed to explore the ways people categorise location information, and who they would be willing to disclose that information to. Results suggest that participants are more willing to disclose social rather than family or medical information. However, it should be recognised that there were much lower disclosure numbers for family and medical clusters compared with social. This is most likely due to the frequency of these items appearing in the overall card sort. The numbers of social and formal social items generated were much greater. In terms of who

would be disclosed to, parents, partners and work relations were more likely to be given information overall. Most disclosure refusals were for financial or anonymous people.

Some of the findings from the disclosure grids were unexpected, such as the higher levels of social information disclosure to work-related people. However, participants often explained their choices in terms of context. As an example, when 'going on holiday due to stress', one participant said they would disclose this information to their doctor and their employer, but not to a friend at work. Disclosing social locations to medical professionals or work people seems unlikely; however it is the *type* of social activity and the relevance to the receiver which determined the disclosure. Participants were also capable of identifying which information would be irrelevant and refuse to disclose it. This research suggests that people do not have an 'all or nothing' approach to disclosure preferences, but will consider who they are willing to disclose to in relation to the activity or location.

6.9.2 What makes people disclose information?

A major reason for disclosure was necessity. Ultimately some of the location activities would involve time off work or university, and participants felt there was a need to inform the relevant people. The type of relationship the person had with the information requester was also important. A number of participants said they would disclose more social activities to their parents, in particular their mothers, because they were already very close to them. This may be related to the higher number of females who took part; perhaps disclosure to parents may have been different if more male participants were tested.

Often participants said they would disclose to people that they might not actually disclose to in real life, but because of the repertory grid method they had to disclose to *somebody*. In this instance, participants tended to choose the least risky or concerning of the three people. In some cases participants ignored instruction and stated they would not disclose to anybody. For example, one participant did not feel that their boss, bank manager or a stranger should have access to information about them going to the supermarket. This suggests that despite the information to disclose being relatively arbitrary, participants still felt a desire to protect their privacy.

6.9.3 What makes people want to hide information?

Generally there were fewer data points for 'no' disclosures. This is likely to reflect the repertory grid format of the study, requiring two 'yes' disclosures, and only one 'no' disclosure. Regardless of this, it is important to consider that most disclosure refusals were for financial, managerial or anonymous people. People did not like medical information and knowledge of their attendance at social/formal social activities being disclosed. In particular, refusals to give a stranger or private company any social location information were highest. A number of participants simply suggested that disclosing certain information to these people would not be relevant or appropriate for the receiver.

6.9.4 Methodology issues

Previous research in this area has often focused on grouping types of people together. For example, one study created three groups for participants to disclose LBS information to: *anyone who asks, anyone who sends e-mail, or anyone from a specified list* (Anthony, et al., 2009). This is just one example of the way in which

researchers tend to classify information for the participant, rather than allowing the groupings to be defined by *them*. The results from this study suggest that within groups there are preferences for disclosure, and an inclusive labelling approach may not be the most suitable to establish individual disclosure preferences.

However, this research has explored hypothetical situations, rather than the immediate assessment of disclosure preferences in a real-world LBS scenario. In particular, participants may have thought about disclosure in terms of potential events- 'if I was going here'. It is not known whether disclosure requirements in the real world would produce the same result. Research has already identified the problems participants have in identifying privacy preferences using surveys compared to in-situ examples (Connelly, et al., 2009). It needs to be acknowledged that because of the hypothetical nature of the task, participants may have believed the threat of information disclosure was unimportant.

Another issue that needs to be considered is the way that participants identified various location examples in this study. The distinction between a location and the *activity* they might be doing at that location was often blurred. For example, a participant disclosing that they were 'at a funeral' leads to the assumption that they were at a church. In contrast, the location of 'at a friend's house' is more ambiguous. Research has suggested that when people request location information, they often really mean to discover the activity the person is doing (Iachello, et al., 2005). The ability to distinguish these information types may have implications for disclosure using LBS when deciding what to reveal to others.

6.10 Chapter summary

This study attempted to find out what types of location information might be disclosed, who the different recipients of these location disclosures are, and how people categorise these location disclosures into meaningful clusters. Using concept elicitation procedures, 83 different 'types' of location information were identified by participants. Information was then gathered about who would be given access to those location types, reported using 'yes' and 'no' disclosure grids. In order to understand how people organise these location information types, multidimensional scaling allowed clusters to be identified, which showed how participants grouped information into family, social, formal social and medical categories.

In previous research, the scope for allowing the user to define their disclosure preferences has been limited. However, this research suggests people have specific preferences when considering the disclosure of location information. Participants were more willing to disclose social rather than family or medical location information, and parents, partners and work relations were more likely to be given this information. In situations when participants were faced with disclosing more personal information to people such as employers or medical staff, context played a large part in determining their choices. These preferences suggest that if given the opportunity, people would utilise personalised disclosure settings within LBS systems.

CHAPTER 7: LBS IN THE WORKPLACE

The previous chapter highlighted issues surrounding information disclosure, how people decide who they want to disclose to, and what kind of information to disclose. Building on the quantitative chapters, the following three qualitative chapters will address the second research question: 'what different contexts affect attitudes towards LBS use?' This chapter will focus on a case study which explored attitudes towards the use of location-based services (LBS) with a lone worker. At the time this study was being planned, researchers in the School of Health Community and Education Studies (HCES) at Northumbria University were trialling LBS technology with staff members. A semi-structured interview was carried out with a member of staff from HCES who took part in a trial using LBS technology in the workplace, with the aim of understanding more about how it was used, and their perceptions of the technology.

7.1 LBS from an employee perspective

A growing number of LBS are aimed at the employer, offered as a solution to their legal obligations and employee safety issues. Employees that are tracked for work purposes often travel for their job, and may spend a lot of time away from the workplace. Emerging LBS are therefore targeted to employers who may be concerned about their employees. LBS products are marketed to offer assurance in the event of staff attacks (Solo Protect, 2011), provide a way to 'comply with new health and safety legal obligations' (Tagtronics, 2011), and offer peace of mind (Safe Trac, 2011). Another motivator for LBS implementation is linked to productivity (Michael, et al., 2006). Some LBS providers emphasise the necessity of such a

system to counteract employees abusing work time (e.g. Mobi.Stealth.com, 2011). It has also been suggested that rather than enabling management to spy on staff, LBS technology could be utilised positively by the employee to manage their own time (Finch, 2010). However, the concept of employee tracking has been scrutinised, and the ethics of workplace tracking have also been queried. In particular, the possibilities for ethical or unethical tracking of employees have been considered (Michael, et al., 2006). Table 7.1 summarises research that has identified the potential outcomes of LBS use in the workplace.

Table 7.1 Ethical issues relating to LBS use with employees (Michael et al, 2006)

Reasons for being ethical	**Reasons for being unethical**
Business owners can increase profits by ensuring employees are working efficiently	Employees may be tracked outside of work hours and the information used against them
Encourages workers to be honest	May be used to unfairly discipline

The considerations outlined in Table 7.1 suggest that the use of LBS tracking at work could result in increased productivity and honesty from employees. However, it also emphasises that information about the employee's location could be collected outside of work, and this information may be used to punish staff. These diverse ethical considerations highlight different ways of thinking about LBS use at work. In order to understand how employees feel about workplace tracking, there is a need to

explore what has been researched to date, and fill in gaps in the literature regarding employee perceptions.

7.2 Workplace monitoring

Researchers have acknowledged that employee monitoring is increasing, in particular the practise of electronic surveillance (e.g. Lee & Kleiner, 2003; Mishra & Crampton, 1998). However, limited research has been conducted to understand how these increases in workplace monitoring may affect the employee, and even less research has focused on LBS implementation.

7.2.1 Workplace trials

Although LBS adoption in work environments has not been thoroughly investigated, the idea of general monitoring of staff has revealed serious concerns about the practice. Researchers have suggested that the introduction of *unwanted* systems may result in psychological barriers between employers and employees (Zweig & Webster, 2002). Their research aimed to understand more about how employees perceived monitoring systems in the workplace. Taking a qualitative approach, the researchers held focus groups with 30 organisational employees in the US. They found that the majority of concerns related to privacy invasion, and specifically, covert monitoring. A concern about performance monitoring also appeared to be more prominent for lower-level administrative staff, whereas senior management were not as concerned. Issues of fairness were discussed, and employees feared that their self-managed work activities would be restricted by a monitoring system. Participants also suggested they would be more accepting if the technology was implemented across the organisation equally. Importantly, participants queried the

utility of the monitoring system over existing technologies already used in the workplace, such as phone and e-mail.

Other specific systems designed to enable employee monitoring have been explored. The Active Badge system, which consists of a location-sensing device, is designed to be worn at work. Infra-red receivers in the workplace pick up signals emitted from the device, and the location of staff as well as times and dates of their movement are recorded. In order to understand the social reasoning behind adoption of these locating systems, interviews were carried out with 44 employees at a corporate research institution (Harper, 1993). The interviews focused on employee ideas about active badges, and possible applications for them in the future. Some participants had experience of using active badges at work, whilst others had refused to adopt them.

Participants gave mixed responses to the active badge system, and location-tracking at work in general. Some people felt that wearing the badge made them part of a forward thinking community, whereas others explicitly said they did not want management to know where they were. There was a feeling that the badges would encroach on personal as well as the work environment. Participants talked of confrontation with other members of staff when they wore their badge, so removed it when entering 'non-badge' areas. Although now quite dated, studies like this show that employee concerns regarding monitoring have existed for some time, and in particular, the idea of monitoring has not been well received.

Another way to explore LBS use in an office environment has been with the development of prototypes. Early work on employee awareness monitoring suggested the use of video displays of colleague activity (Hudson & Smith, 1996).

This work influenced more subtle research carried out in the workplace. For example, the 'Whereabouts Clock' aimed to support people at work by giving an 'at-a-glance' display of information when they needed it (Sellen, Eardley, Izadi, & Harper, 2006). A clock-type design was made to be placed on a wall in the office environment, available to all who occupied that space. The clock would broadcast relevant information of the whereabouts of colleagues that were linked to it. For example, people could be viewed as 'in the building', 'home', or 'out'. The clock also allowed users to be more specific about their location, which would be displayed as text around their image (Figure 7.1).

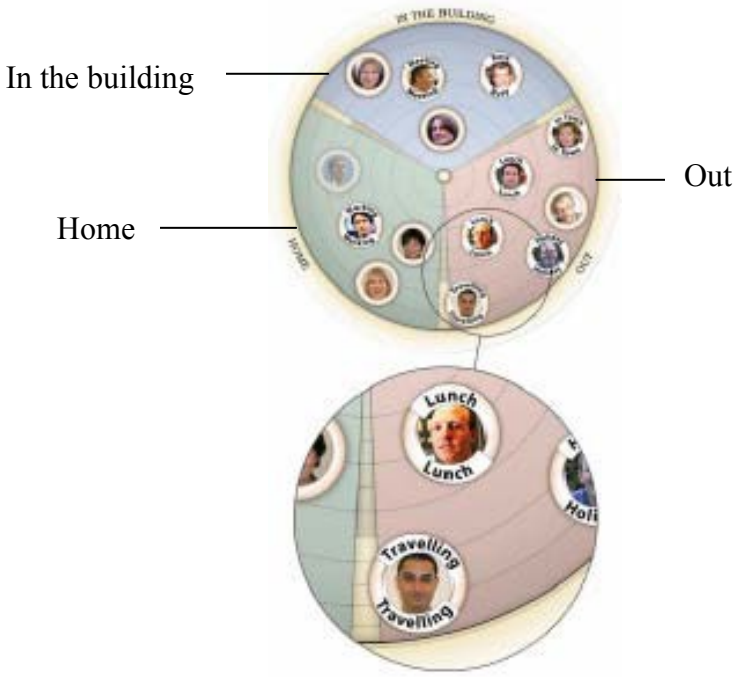


Figure 7.1 The Whereabouts Clock for the Office (Sellen et al., 2006)

A trial was conducted in the office of the developers of this technology, using 14 volunteers. The users of the whereabouts clock reported feeling a greater connectedness at work, and liked their virtual presence when they were out of the

office. It also allowed users to notify large groups of people of their status, rather than sending individual e-mails. It was also used to check where people were, or locate them if they were absent. Users reported that visual representation of colleagues 'fostered a sense of community' (Sellen, et al., 2006, p. 1311). However, participants felt that the rudimentary nature of the location descriptions were too restrictive, and they wanted more detail to be displayed about their location or activity. Nevertheless, this trial suggested that in small work groups, the use of a device which is able to locate colleagues is perceived as useful.

7.2.2 University-based trials

Other trials of LBS have been conducted with small groups of employees or researchers. For example, the prototype PeopleFinder system was tested with a research team and students based at Carnegie Mellon University (Sadeh et al., 2009). The aim was to explore people's privacy preferences as they interacted with an LBS application. Similar to other peer-sharing systems, the PeopleFinder platform allowed users to share their location using a personalised map (Figure 7.2).

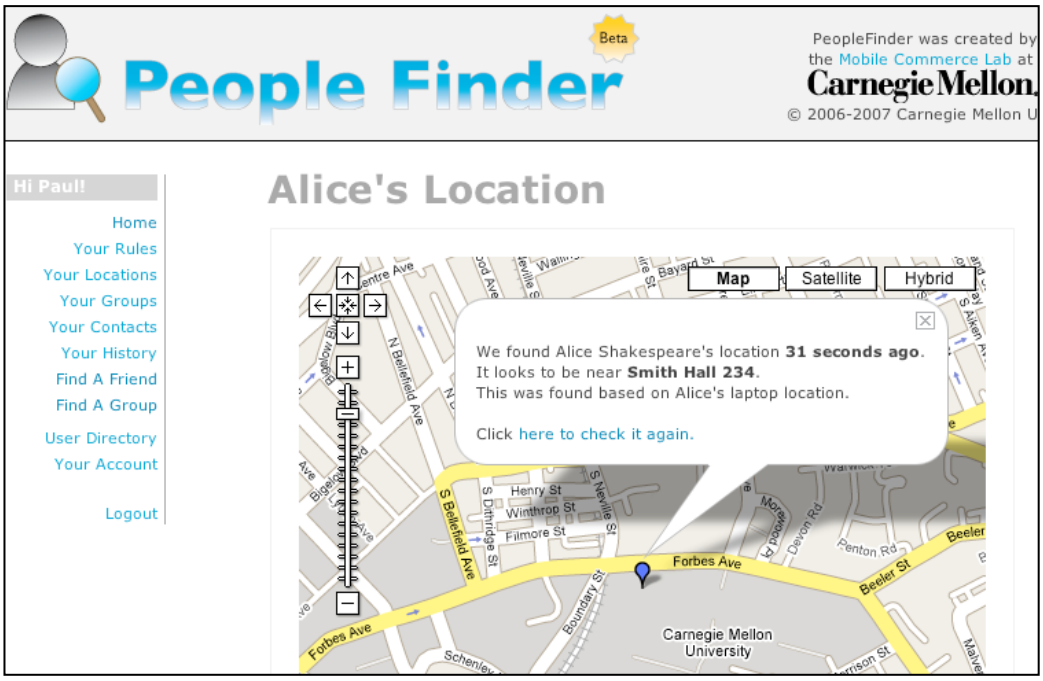


Figure 7.2 The PeopleFinder platform (from Sadeh et al., 2009)

The trial also allowed staff to refine their disclosure choices via the platform by adding rules, which decided who could have access to their location information. Results suggested that with more familiarity and understanding of the technology, users were more relaxed about responding to location requests from other users. This research clearly shows that when colleagues are required to disclose location information, a thorough understanding of the technology encourages more trust and use of it. However, the use of students and staff already familiar with the technology in this study is a major limitation; research would benefit from knowing about the experiences of real world users.

7.3 Method

In order to add to the quantitative findings outlined in chapters 4 and 5, a case study was conducted to find out in more detail how users of LBS perceived the technology. This research intended to explore issues of LBS use in a workplace environment, involving people with experience of LBS, and being of relevance to industry.

An LBS trial was scheduled to go ahead in October 2009 with a group of employees from Northumbria University based in the School of Health, Community and Education Studies (HCES). The trial was conducted because the university wanted to assess different ways to be able to monitor their staff who primarily worked out of the office. The number of participants in both the trial and this study intended to be larger, with three or four people being recruited for interview after the trial. However, due to participant concerns about data gathering and privacy, there was only one person who volunteered and completed the trial for HCES. This in itself is an indicator some of the issues surrounding LBS tracking in the workplace.

7.3.1 Participants

The results focus on one qualitative interview with the participant who completed the trial. The participant was female, aged 27, and worked as a researcher at Northumbria University. She agreed to talk at length about her experience using LBS technology. The participant used the LBS technology during work hours for a period of approximately 4 weeks.

7.3.2 Materials

During the trial, the LBS system was imbedded in an Identicom badge (see Figure 7.3) supplied by a North-East LBS provider. The Identicom badge uses a discreet alarm, disguised to look like a normal identity badge. Its in-built functionalities allow the LBS provider to listen in to any situation once a red alert button has been pressed, locating the lone worker, and responding should they trigger a red alert or fail to return to work.

Figure 7.3 The Identicom badge used in the trial

7.3.3 Developing an interview schedule

A semi structured interview schedule was developed (see Appendix 11.13) and used during the interview with the participant. The interview schedule was designed to explore some of the issues identified in the new LBS model (chapter 5). For example, the participant was asked about perceived usefulness of the technology at work, perceptions of the LBS provider, and feelings towards her employer.

It has been suggested that using an interview methodology 'has the potential of providing rich and highly illuminating material' (Robson, 2002, p. 273). However,

potential interviewer bias, leading questions, and jargon mean it is not an easy research methodology to undertake. A number of steps have been recommended to help researchers structure their interviews, such as explaining the purpose and nature of the study, giving assurance to the participant that they will remain anonymous, telling the participant something about themselves (background/interest in the area), and asking permission to tape-record the interview (Lofland, Snow, Anderson, & Lofland, 2006, p. 104). These steps were followed in this interview, and the qualitative studies reported subsequently in chapters 8 and 9.

7.3.4 Analysis

The interview lasted approximately one hour, was tape-recorded and then transcribed. The transcription was analysed using qualitative methods with the aid of NVivo 8 software. To guide the analysis, the factors that emerged from the questionnaire study in chapter 5 (e.g. trust, usefulness, disclosure) were drawn upon. However, the analysis was not restricted to these groupings.

Once the themes in the data had been identified, a method of verification was carried out. The analysis was subject to a mini-audit by two members of academic staff at Northumbria University, who concurred with the theme constructs. This practise has been recommended to aid the analysis of qualitative data (Smith, 2007, p. 235), and was conducted with all three qualitative data sets reported in this thesis.

7.4 Results

Analysis of the interview identified 8 main themes within the data. A summary of these can be seen in Table 7.2. Each theme will be discussed in detail below.

Table 7.2 Summary of themes identified in lone-worker interview

Theme	Quote
Safety	'For me it was primarily about doing something that makes me safer, so I was willing to let the other things go'
Usefulness	'I can't really think of where else you'd use it other than going out into people's homes or [...] not very nice areas'
Training issues	'I don't think I ever fully understood when I was supposed to wear it and how often I was supposed to test it'
Trust in LBS provider	'It would help to have someone there rather than on the end of the phone'
Trust in employer	'The university is my employer, so they've got a right to know where I am'
Disclosure to employer	'I think some people had issues about filling in the forms with their own phone number, and wondering where that had been stored'
Technical problems	'There were times when I just couldn't work out whether I had it on or off'
Visibility	'It would feel a bit conspicuous (ID badge). I think maybe I would have preferred the phone'

7.4.1 Safety

The participant felt that using LBS technology would benefit people who may be at risk during work: *'a social worker could go to someone's house to do their job, but a gas man could go to the same house [...] and they might be at risk.'* The participant also talked about accepting the technology because of the protection it could offer her: *'I understood this trial was about my safety, and using it at times when I felt my safety might be at risk. So I was quite happy doing it for that purpose.'* She also said using the system to feel safer involved letting 'other things go'. This suggests she

was aware of a trade-off between safety and being located by her employer, but safety was the motivating factor to use the technology.

Despite this motivator, she pointed out that she had never really felt unsafe when working out of the office, yet could see the benefit of the technology in situations she'd experienced in the past: *'I was in the car on my own with this man that I'd only just met. That would have been a good situation to set off the amber alert so someone knew what was happening.'*

7.4.2 Usefulness

Perceptions of safety had an impact on feelings about the usefulness of the technology. The participant described existing safety procedures that were in place at work, and how they compared to the LBS technology: *'In an ideal world I'd prefer the system where a colleague knows where you are and rings you [...] people were forgetting to ring me, so it doesn't really work like that. This [LBS] does seem like a good alternative to that.'* The system was deemed useful in terms of automatic monitoring, but the participant still maintained that a more personal system was desirable: *'I'd rather just have the system where I let someone know where I'm gonna be and they call me if there's a problem.'* The participant also maintained that the only use she could see for LBS was to help people *'going out into people's homes or [...] not very nice areas.'* There were, however, problems with understanding the purpose of the technology, which impacted on perceptions of usefulness: *'It wasn't until afterwards and my boss asked me to give her feedback, I said I couldn't really understand the point [...] obviously people would only know where you are when you set off an alert.'*

7.4.3 Training issues

The lack of understanding may have been due to problems with the set-up of the trial, and insufficient training. This omission caused a problem throughout the trial: *'I never got any training from them myself. So she [a colleague] just showed me how it [LBS] worked and left me to get on with it. I don't think I ever fully understood when I was supposed to wear it and how often I was supposed to test it.'* The participant also said the LBS provider contacted her, asking her to use the functions of the technology, however the purpose was unclear to her: *'I started getting calls [...] saying can you put it on all the time and test it every week. I thought no one's ever told me that, no one's explained the purpose of that or anything.'*

The lack of initial contact with the LBS provider ultimately had a negative impact on LBS perceptions, and the participant acknowledged it could have easily been improved: *'It's a shame, I think if I had some training from them beforehand, and a chance to speak to them, the whole thing would have been much better.'*

7.4.4 Trust in the LBS provider

This lack of contact and understanding of the LBS provider's role influenced feelings of trust about them. Not knowing who the company was became a problem when trying to use the technology too: *'I assumed they would send out a search party, but I didn't know who they were, whether they would get in touch with the police or who would be responsible.'* The participant described how the LBS provider was very helpful when she did contact them, but were described as *'just people on the end of the phone.'*

When asked about who should manage this kind of service in the future, she said *'I think you need to see someone face to face, I think that's why I had the problems.'* Despite the lack of initial contact, the participant still believed the LBS provider would be the best way to manage the system: *'It would probably work best with them [LBS provider] because that's their dedicated job.'*

These comments highlight the importance this participant placed on building up a good relationship with the LBS provider, and the value of face to face contact. These comments confirm the results from the new LBS model (chapter 5), which suggested that trust in the LBS provider was an important predictor of intentions to use LBS.

7.4.5 Trust in employer

Feelings towards the employer during the trial were mixed. The participant felt her employer had her best interests in mind, but this contrasted with a growing concern for the reasons *why* they were interested in monitoring staff. The participant acknowledged that *'the university is my employer, so they've got a right to know where I am.'* She also talked about her manager 'selling' the concept of the trial to her. When asked to complete a personal information questionnaire before the trial, she said *'I just filled it in! It really didn't bother me'*.

However, this outlook was not shared by all members of staff. Despite the participant identifying herself as quite trusting, she said *'even I would start to wonder if they said "we want it on all the time". You'd start to wonder why they wanted to know.'* The participant also noted that other members of her research team queried the trial: *'Some of the older, more cynical people think "why should the university know*

where I am and tell me what to do" and things like that.' These perceptions of the trial go some way to explain why other people did not want to take part.

7.4.6 Disclosure to employer

The participant talked about a lack of trust towards the employer, originating from the requirement for all trial participants to disclose personal information. The lack of knowledge about how personal information would be managed impacted heavily on attitudes: *'I had to fill in a form beforehand that gave a physical description. Again, that wasn't really explained [...]. I know there were some colleagues who wanted to trial it and refused because we were told to fill it in. It asked for your height, weight, ethnicity, things that might be considered personal. We weren't told where that was going.'* The other volunteers were not only concerned with the reasons behind the collection of this sensitive information, but wanted to know how it would be stored and who had access to it. Reiterating the point, she says: *'One colleague was keen to take part in the trial, and then when she started getting these forms she started thinking it was a bit of an invasion of privacy.'* These practises, although most likely a requirement from the LBS provider, caused concern for participants. This could have been avoided had the employer clearly stated the purpose of the forms, and how information would be managed.

7.4.7 Technical problems

The participant experienced a number of technical problems when taking part in the trial: *'Because no one had explained the technology beforehand, I was trialling it when I was out and about, and they started saying can you [...] press the red alert at least once a week. I started off trying to do that and I just couldn't get it to work, so I*

thought it must be broken.' Although the nature of a trial is to identify problems, the technical problems experienced by the participant were mainly as a result of a lack of training and knowledge about how the technology worked. The participant discussed physical issues with the device such as pressing the button, or signal problems which meant certain areas were 'black spots' and the device wouldn't work. This in turn caused other inconveniences to the participant, such as walking *'halfway down the road to put it on'*, in order to get good GPS coverage. These issues could have been resolved had a formal training stage been completed prior to the trial.

7.4.8 Visibility

One of the unexpected themes which emerged related to visibility, and how the LBS device impacted on the behaviour of the participant and the people around her. She describes her feelings towards the alert system that was embedded in the Identicom badge: *'It's hard to press the button when you're in a car with someone and they're watching you [...] some things might make someone do something more drastic.'* This suggests she had a fear of causing a scene or escalating an already tense situation, with the device functionality being an issue.

The participant also acknowledged that when visiting people alone, the ability for the LBS device to look inconspicuous would be important. The context of her work meant that wearing an ID badge felt out of place: *'My research is specifically about lay workers- I ask lay workers about whether they wear name badges. So I just felt specifically to my research, it felt a bit odd wearing it. So I started putting my badge in my bag and no one saw it.'* These comments suggest that design of the device may influence the amount it is used, depending on the work patterns of the user.

The participant also expressed concern about the visibility of *her* participants: *'In my research I promised people that no one would find out they had taken part in research and obviously not find out where they lived [...] if someone was keeping a record of where I was then you could possibly trace that back to my participants.'* In this case, the collection and storage of information not only affected the user of the LBS technology, but caused ethical concern for the identification of the wider community.

7.5 Discussion

The themes identified in this study provide further support for the factors identified in the new LBS model outlined in chapter 5. In this case study, issues of trust towards the employer *and* the LBS provider were identified, as well as concerns about disclosure of information. A lack of trust of the LBS provider and employer influenced the participant's feelings about the LBS trial, and attitudes towards continued use of the technology.

The technology was perceived as being useful to an extent; however the participant reported that she felt existing safety procedures at work were preferable. This has been found in other studies where participants prefer methods of communication that are already in place at work (Zweig & Webster, 2002). Those existing practices were not necessarily deemed better than the LBS technology, but seemed more familiar and human-centred. In general, the participant felt that the LBS system was useful for lone workers. She perceived the technology as a safety mechanism, but she didn't need to be in danger for it to offer her peace of mind. However, the *type* of device given to the participant was not suited well to her type of work. She felt wearing a

name badge caused there to be a divide between her and the people she was visiting. The compatibility of the device with her work practises was poor, and more thought should be given to the way the technology is designed and the context in which it may be used.

It was important for the participant to build up a good relationship with the LBS provider, and because this did not happen there was confusion about using the system. The importance of a good relationship with the LBS provider, and in particular, the importance of face to face contact was an unexpected finding. The development of this relationship is something which needs to be considered by industry, to realise how important relationships with users are. The participant explicitly suggested that more familiarity with the LBS procedures, by means of training and contact with the LBS provider, would have improved the trial. This study revealed that there was also a need for more communication with the employer. Requesting personal information and not explaining where it would be stored or who would see it caused a number of people to withdraw from the trial, and brought into question employer trustworthiness. A number of volunteers had not gone through with the trial because information gathering was not fully explained to them. These findings provide additional evidence in support of the LBS model; usefulness, trust perceptions and issues of disclosure were considered by the participant, and influenced their decision to use the technology in the future.

7.6 Chapter summary

The trial of LBS technology in this instance was a success, with the participant acknowledging that if used properly, the technology could be useful in her field of work. However, there was an obvious desire for more meaningful contact, both with her employer and the LBS provider. Supporting the factors identified earlier in the revised LBS model (chapter 5), this study suggested that a lack of information flow can cause mistrust and uncertainty of the LBS provider and employer. These findings highlight that potential LBS users need sufficient training and knowledge of the reasoning behind information-gathering practises in order to feel comfortable. In turn, this increased communication between people involved in the LBS process should build up trust and increased confidence for the user. In order to establish if LBS technology is perceived in the same way by different types of people, the next chapter explores the attitudes of older adults who have experience of using LBS in the home.

CHAPTER 8: LBS APPLICATIONS WITH OLDER ADULTS

The term ‘silver surfer’ has become a familiar and widely used term in the media (Roberts & Wallop, 2010). The notion of older adults using technology is beginning to be assessed in a more purposeful and beneficial way. Researchers have noted that consultation with older adults is a good way to understand their needs and the design issues they may face (e.g. Hirsch et al., 2000). Initiatives such as the New Dynamics of Ageing project, a collaboration between five UK Research Councils, are beginning to explore how and why older adults use technology (NDA, 2011). This qualitative study has a similar aim- to explore the attitudes of older adults in terms of LBS technology, its uses, and how it may be incorporated into their lives.

8.1 Technology use with older adults

Despite media reports of older adults becoming more technologically ‘savvy’, research suggests there is still a lack of adoption within this population (Coleman, Gibson, Hanson, Bobrowicz, & McKay, 2010). Research has often focused on how older adults access various technologies. For example, research involving 352 older adults found that age was significantly related to computer access, with younger people able to access more technology than older people (Selwyn, Gorard, Furlong, & Madden, 2003). It was also found that despite the majority of older adults having access to more common technologies (e.g. telephones, televisions, radios), only 15% of respondents had access to the internet in their own home. Children and other family members were the main source of actual, as well as potential support to use technology.

Despite these figures, more services *are* being developed which enable older adults to become part of the technological world. For example, a website forum designed specifically for older adults has been created which allows users to swap stories and learn various skills. One recent article was entitled 'Granny dos and don'ts: How to be the most popular person in the family' (Gransnet, 2011). Mobile phones are also being designed for simplicity, boasting features which can help with impaired sight, hearing and memory problems (Doro, 2011).

8.1.1 Technology adoption

Research has looked at the adoption of technology use with older adults in terms of their *motivations* (Selwyn, 2004). Findings obtained from qualitative analysis of in-depth interviews with adults ranging from 61 to 84 years old suggested the main motivating factors for use of a computer included being able to keep up to date, embarking on new projects or hobbies, and perceptions of usefulness. Some participants used computers for online shopping or banking, and felt that being prepared for old age and immobility required use of a computer (Selwyn, 2004). Interestingly, participants less willing to use computers felt that using one was merely a hobby rather than a useful tool in its own right. Many were using computers to support a project or leisure activity which was not computer-based. They also expressed a lack of interest in using computers, which wasn't mediated by a lack of knowledge or availability. It is often the belief that people wish to use technology, but they simply haven't had the appropriate access or training. Research suggests that one reason technology may not be adopted is due to a lack of willingness.

Modifying the Technology Acceptance Model (Davis, 1989) researchers have shown there are clear differences in acceptance and ability to use technology depending on age (Arning & Ziefle, 2007). Arning and Ziefle proposed a new model to account for acceptance of technology (Figure 8.1). In their study of 32 varied-age adults, personal digital assistants (PDA) were given to participants, requiring them to enter information into a 'digital diary'.

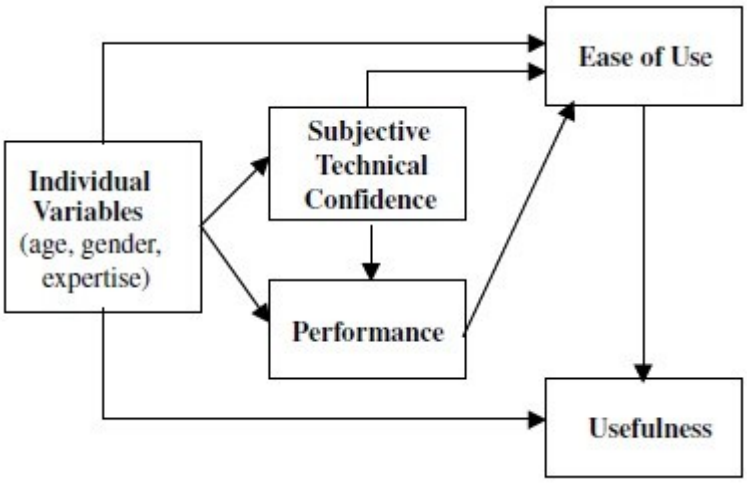


Figure 8.1 The proposed research model (Arning & Ziefle, 2007).

The older adults who participated were found to have lower technical confidence, ease of use and perceived usefulness scores compared to younger participants. Acceptance of the PDA was determined by ability, perceived ease of use, and moderated by user age. In order to reduce the likelihood of difficulties using the device, it was recommended that the practical benefits should be emphasised to the older adult group.

Gathering data from the literature led researchers to later develop the *Senior Technology Acceptance & Adoption Model (STAM)* (Renaud & Biljon, 2008).

Building on the Technology Acceptance Model and incorporating data from older adult interviews, the STAM consists of user context, perceived usefulness, intention to use, experimentation and exploration, ease of learning & use, confirmed usefulness and actual use factors (Figure 8.2).

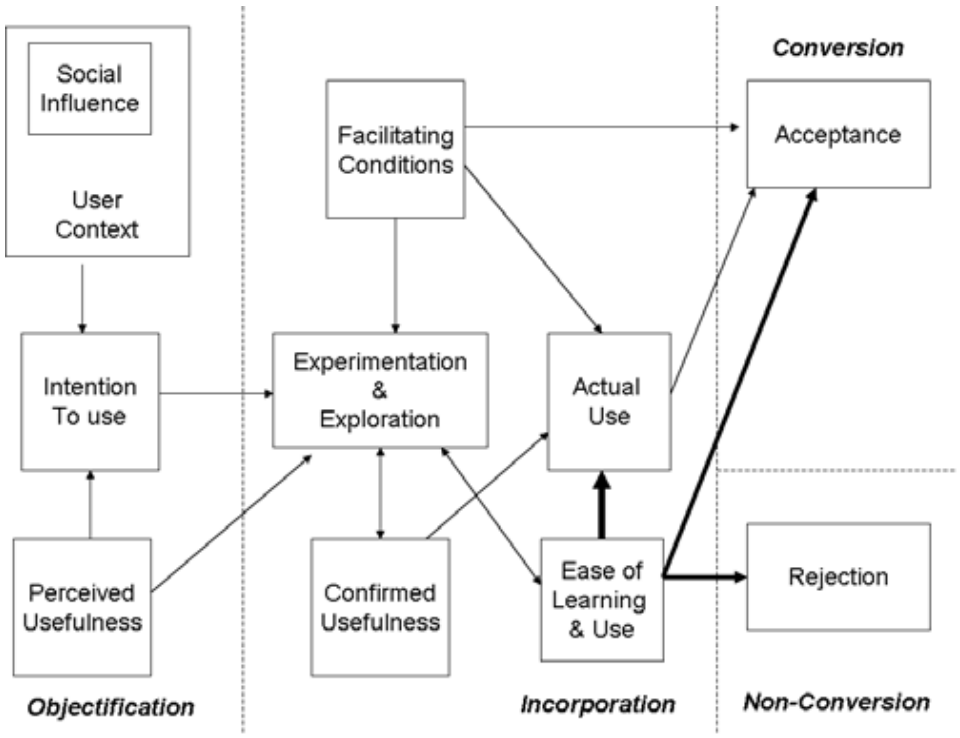


Figure 8.2 The STAM (Renaud & Biljon, 2008).

The additional concepts include *user context*, *experimentation and exploration*, and *ease of learning & use*. User context considers demographics such as age and functional ability. Experimentation accounts for the new adoption of a technology, and how it will influence usefulness ideas. Any decisions about the technology at this point will feed back to the confirmed usefulness stage. Ease of learning focuses on the reality that older adults may find a new technology difficult to use. This model 'depicts the transition from usage to acceptance and conversion (adoption)' (Renaud & Biljon, 2008, p. 217). However, authors noted that acceptance may often be

compromised if poor ease of use is experienced. This model differs from other acceptance models as it includes an opportunity to use the technology, to learn from it, and to subsequently evaluate it. Results from qualitative interviews regarding mobile phone use suggested that the STAM does provide an explanation for the non-adoption of technology in older adults.

8.2 Assistive technology

There is a wealth of literature on technology use and the elderly which focuses on assistive technologies in the home. Often the rationale for using assistive technology is the independence it may bring for the older adult, remaining at home for longer without the need for institutionalisation. Research has also shown that despite people not necessarily needing any direct assistance, technology in the home can be perceived as useful by family members in providing peace of mind (Rowan & Mynatt, 2005). Research into the motivations to use these technologies, however, has been limited. Some research has explored the value of assistive technology for older adults, and has shown they are perceived differently (McCreadie & Tinker, 2005).

In Sweden, where there is an ever-growing elderly population (Sweden.Se, 2011), research has focused on the preservation of autonomy and independent living using a 'mobile safety alarm' (Melander-Wikman, Fältholm, & Gard, 2008). This alarm incorporates an inbuilt drop sensor and GPS capabilities to allow mobility to extend beyond the confines of the participants' home. Feelings of safety were the main reason participants felt they needed an alarm system. Some participants felt they were vulnerable to crime, and the system would be helpful to warn the authorities. The responsibility of the alarm call responses was agreed to be someone in authority,

preferably with medical competence. In terms of location-tracking, participants felt the system could only be a positive addition, and the idea of having nothing to be ashamed of or hide from anyone was prominent. However, there was a sense of resignation that accompanied technology acceptance, and participants believed monitoring was becoming commonplace.

It has been noted that we cannot design assistive technologies without considering the social, emotional and environmental needs of older adults. The simple way we interact with a device, and preferences for use of technology has been shown to be different for older adults (Stößel & Blessing, 2010). For example, time management devices and memory aids have been perceived as stigmatising (Giusti, Mencarini, & Zancanaro, 2010). Embarrassment about the reliance on stigmatising devices may cause older adults to reduce their desire to socialise (Hirsch, et al., 2000). We cannot assume that simply because an older adult may *need* to use an assistive technology, that they will necessarily adopt one.

8.2.1 LBS, older adults and privacy

Tracking technology has shown to be increasingly useful to measure older adult mobility (Shoval, 2010). Rather than monitoring being regarded as a privacy *reducing* tool, research has suggested that because of the freedom it may allow, older adults indirectly perceive the technology as enabling more privacy (Essén, 2008). In a community in Sweden, 17 older adults were asked to wear a monitoring device on their wrist. The care centre they were monitored by collected 'activity data' about them using the device, but the participants were living in their own homes at the time of the trial. Similar to other monitoring devices, it would set off an alarm if the

wearer's usual activity patterns were breached. After a 6-month trial, interviews with users revealed contradictory perceptions about the system. The majority of people felt positive about being located, and felt the technology was caring for them. This monitoring system was viewed as superior to a previous alarm system, which required them to press a button in an emergency. One resident pointed out that 'I might not be able to press the button if I am laying on the floor dying' (Essén, 2008, p. 132). A major finding was that users believed because they were willing to try this new device, they could remain independently living in their own homes.

Older adults have also been suggested as a group to consider in the technology design process (Osman, Maguire, & Tarkiainen, 2003). Osman et al. devised scenarios of LBS use and conducted focus groups with young (20-25 years) and old (55+ years) participants, asking them what they considered to be important when deciding to use LBS. The older adults' requirements are displayed in Table 8.1.

Table 8.1 Concerns regarding LBS use for older adults (from Osman, Maguire and Tarkiainen (2003)

Primary	Secondary	Tertiary
Reliability of information	Alternative routes/options	Flight bookings
Personalisation of LBS services	Alternative routes/options	Receipt printing
Integration into mobile phone	Zoom in/out	Colour screen
Accuracy of information	Large screen	Guide book facility abroad
Low cost of LBS service	Useable abroad	
Ease of use (device and service)	Information about charges to use	
Up to date information	Translation facility	
Maps for routes	External service cost information	
Landmarks for places	Check stock in shops	
Directions to places	Print facility	
Access of location for police	Ability to locate lost people	

Focus groups revealed that older adults had more positive perceptions and attitudes towards LBS than younger users. For example, the older adults felt that using LBS to find out about shopping promotions was useful to them (location-aware capabilities). It is also important to note that reliability of information, ease of use and the ability to personalise information were of primary concern. These preferences suggest older adults have similar concerns about LBS as do younger populations. This research shows that older adults can be included in the assessment of technology, and consultation with them may impact on their adoption of LBS technology in the future.

8.2.2 LBS use with dementia patients

Dementia patients are often cited as a group who could benefit from LBS. Dementia symptoms can include memory loss, confusion and mood changes. It is estimated that around 820,000 people in the UK have dementia (Alzheimer's Research UK, 2011). The effects of dementia are debilitating, causing 'disorientation in time' and 'loss of spatial orientation' (Müller, Wan, & Hrg, 2010, p. 75).

Using LBS technology with dementia patients often raises ethical concerns. Interviews with Alzheimers patient caregivers have suggested that although each case is unique, they believe free-will is important to maintain wherever possible (Müller, et al., 2010). Carers also suggest that an LBS system would be beneficial when patient wandering occurred, as it would help them identify where to look first. The use of LBS in this situation was described as 'a possibility of relief' (Müller, et al., 2010, p. 80), in the event that someone became lost. Caregivers noted the freedom *they* would enjoy if LBS was implemented, and the autonomy it could foster

in the patients. Other research has supported the idea that LBS would offer peace of mind for the caregiver (Landau, Auslander, Werner, Shoval, & Heinik, 2010a). One view has been that patients with dementia would receive *more* autonomy if they accepted a GPS tracking system, rather than less (Landau, Werner, Auslander, Shoval, & Heinik, 2010).

Research has also shown that perceptions of older adults who are 'cognitively intact' should be taken into consideration when thinking about dementia users (Landau, Werner, et al., 2010). 'Cognitively intact' participants were involved in focus groups and given questionnaires, during which time they were asked about their attitudes towards GPS tracking of dementia patients. Participants indicated that patients should be able to give consent to being tracked, whereas others acknowledged that after a dementia diagnosis, consent and privacy rights were not always feasible. Other findings suggest that a spouse or close family member should be given priority in terms of deciding whether or not to adopt GPS tracking (Landau, Auslander, Werner, Shoval, & Heinik, 2010b). These studies support earlier findings which suggest that using the right kind of technology, and with ethical approval, electronic monitoring of dementia patients can result in positive outcomes (Miskelly, 2004).

Researchers are increasingly acknowledging that technology design should be inclusive, and because older adults are a growing user-group, consideration of their needs is essential (e.g. Pattison & Stedmon, 2006). However, in spite of the research focused on LBS use with dementia patients and their caregivers, perceptions of LBS from a healthy older adult perspective has not been investigated.

8.3 Method

8.3.1 Participants

This study utilised a group of older adults who had experience of using LBS as part of previous mobility research they had participated in at Northumbria University. In that earlier trial, conducted throughout 2009, participants were given the use of 'i-Locate', a location tracking pack. The pack was worn for approximately one week by each participant, during which their movements were recorded and subsequently stored for 3 months. The aim of this previous study was to assess levels of mobility. Participants had not been asked to evaluate the technology at any point.

The GPS tracking kit for the trial was supplied by TrackaPhone. The unit was worn discretely around the arm (Figure 8.3). One charge lasted for approximately 48-hours and when not being used (i.e. when participants were in their home) the device was stored on a charger. When the device wasn't charging, location information was sampled every 2 minutes.

Figure 8.3 Example of the i-Locate pack worn by participants

In this new study reported here, participants were obtained from the previous research database. Twenty older adults, who were known to have taken part in the earlier trial, were sent a letter requesting their participation in a new study. A week later each person was telephoned at home to see if they were interested in taking part, providing them with more detail about what was required of them. Of the 20 people contacted initially, 13 agreed to take part. Of the seven who declined, some reported ill health, or a move away from the North-East. Participants consisted of N= 10 female, and N= 3 male, with a mean age of 82.7.

8.3.2 Procedure

Once each participant had agreed to take part in the study, a time was arranged to visit them in their own home. Each participant was interviewed following a semi-structured schedule, and all interviews were tape-recorded. Interviews lasted between 20 and 45 minutes. The letter that was sent to participants and the interview schedule can be seen in Appendix 11.14 and 11.15.

Prior to each interview participants were given an information sheet, asked to complete a consent form, and were given the opportunity to ask questions. After the interview, a debrief sheet was provided along with a verbal explanation of the study.

8.3.3 Materials

During the interviews example maps of location data were given to participants to aid discussion. The maps were not of individual participant locations during the earlier trial, but were used to remind them of the resulting trial data (see Figure 8.4).

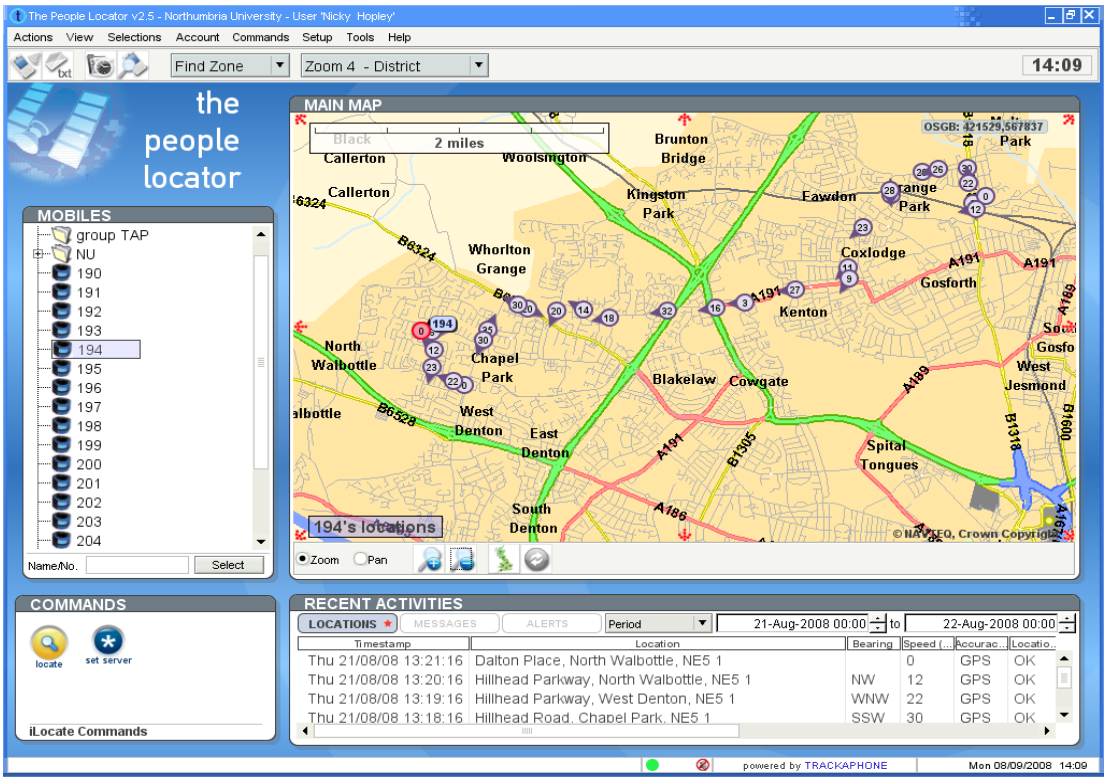


Figure 8.4 Sample map from New Dynamics of Ageing research

8.3.4 Analysis

The interviews were transcribed verbatim, and analysed within the qualitative programme NVivo 8. An exploratory data analysis approach was used to be able to identify as much useful information as possible from the transcripts. This method is often used with interview data, and has been used when exploring the views of older adults (Landau, Werner, et al., 2010).

Looking at the research that has already been conducted with older adults and technology adoption (Little & Briggs, 2008, 2009; Little, Sillence, & Briggs, 2009), a framework emerged that could be used to guide this data analysis (Little, et al., 2009). The hypothetical technology explored was a PDA which would provide a user

with a personalised shopping list, derived from a monitoring system linked up to their fridge and cupboards in the home. It would notify the user of essential grocery items needed that week when they were at the supermarket. The PDA also allowed shopping to be paid for biometrically with a fingerprint. A 'Pre-Concept Evaluation Tool' (PRECET) was identified from the analysis of interviews with older adults in that study. This tool identified 5 key questions to consider:

1. *Is it usable?*
2. *Who controls?*
3. *Who sees?*
4. *Who benefits?*
5. *Who takes responsibility?*

Analysis of the interviews with the participants related to four of these five key questions identified. These are discussed below, and are summarised in Table 8.2.

Table 8.2 Summary of qualitative findings from older adult interviews

Theme	Code	Quote
Is it usable? (technology acceptance)	Attitudes towards technology	*"I can't see the point in me having a computer. I can't see that I would use it such a lot"*
	Usability, navigation and understanding	*"It won't pick up whether I go from here to the kitchen, will it?"*
	Apathy	*"I can't think of anybody who'd be interested at all"*
	Advance on existing systems	*"My daughter lives in Edinburgh. I contact her every morning just to know that I'm here"*
	Is it useful?	*"I can't see that at the minute it's any use to me"*
Who controls?	Who are the stakeholders?	*"If you think their motives are okay then I have no problem, but it's the motives every time"*
	Imposition/Autonomy/Choice/Resignation	*"Whether it would be a bit Big Brotherish if you had it on all the time, if you had to wear it. It's a question of obligation really"*
	Stakeholder credibility/trusted people	*"Whether it's old age or not, I have no faith in anybody shall I say"*
	Security/Data abuse/'Wrong hands'	*"I can see the good side and the bad side of it in the wrong hands"*

Who sees?	Informational privacy	*"As long as it can't be traced to me I don't mind who knows"*
	Secrecy	*"Say if you were worried about your health and you were getting investigations done. You might not want everyone to know"*
	Patterns of behaviour/vulnerable to crime	*"With greater theft, you don't want to publicise you were going away for the next six hours"*
	Nothing to hide	*"I mean I'm an open book"*
	Transparency- who has access?	*"I don't mind Northumbria having it but I don't think I would want it available to more or less anybody"*
	Who is trusted to see the data?	*"Outside the family it's none of their business"*
Who benefits?	Context	"*If I were in need, if my mind had gone, I wouldn't mind because it would be far less trouble for the children"*
	Physical safety	*"If I'm going to fall and break my leg again I want someone there picking up the pieces"*
	Vulnerable people	"*People that suffer from dementia, they could get it. If they wore it all the time it could be very useful*"
	Anxiety reduction/reassurance	*"Well I suppose if you're going to have a heart attack or something, you'd be quite glad"*

8.4 Results

8.4.1 Is it usable?

Attitudes towards technology

Feelings towards new technology expressed by participants were influenced by their previous experience with other technology they had encountered. Feelings about technology were expressed in two main ways: distaste for computers, and a preference for existing ways to communicate with others. Talking about technology in general, participants stated that they felt computers were not useful or relevant to them: *"I have no need for a computer. I am resisting it because if I had one I would spend so much time and money on it, so I don't want one"*

There also seemed to be an inherent fear of the unknown: *"I had a horrible feeling you were going to ask me about computers and things"*. Many participants talked about their limited understanding of computers in general. In terms of other ways to communicate, participants said they preferred more traditional methods rather than adopting new technologies: *"I can do very well with the telephone or occasional letter or whatever"*. A few participants did consider the advantages of using something like a computer or e-mail, but also felt that they may waste a lot of time in doing so.

Advance on existing systems

As well as other methods of communication being favoured, participants talked about their existing strategies which allowed themselves to be located by others;

participants felt that using LBS to locate an individual was just a newer way to do so. Participants discussed existing practises for keeping in touch with friends and family, with some methods being more direct than others. One participant claimed she telephoned her daughter every morning to let her know she was well. Another consciously created a diary record of her movements: *"I've often thought I get the metro from here and I go into Gateshead. That's why I always put my diary in my handbag"*.

Usability, navigation and understanding

A dislike for technology, and computers in particular, was compacted by the confusion that some participants experienced when trying to use LBS. When describing her mobile phone, one participant said *"I've got one I've had for months, but I still can't use it!"* Another participant pointed out that she couldn't follow instructions for the LBS equipment, and that *"it has to be told twice to sink in."* Participants reported difficulties during the trial, with one person failing to take the device out of the box properly, which resulted in a lack of data collection and the trial being conducted again.

In terms of advanced use of LBS technology, one participant explained *"I suppose I could maybe get to grips with the basics of it, simple stuff, but I don't know that I would get involved with lots of detail"*. Some participants believed there was an inherent ability required to use the technology properly: *"It would demand a certain amount of technical skill I think"*. In contrast with this, a number of participants felt that the LBS trial was quite simple, and did not require much effort on their part. One participant added *"If you can use it with me, you can use it with anyone"*.

Despite the hesitance of participants to become familiar with LBS technology, most could see the usability of it for other groups, but stated that practical issues would need to be addressed: *"I think it possibly could be good for people. If you're talking about Alzheimer's say, who weren't in the early stages. They might not have the sense to put it on"* and *"It would need to be around their neck and maybe fastened on"*. These comments suggest that older adults can assess the technology, and consider potential design implications for real-world use.

Apathy

A number of participants felt indifferent towards the technology, and could not see any benefit for them in using it. Despite participants acknowledging the usefulness of the LBS system for other people, they could not comprehend that people would ever be interested in locating *them*. One participant stated *"It wouldn't worry me anybody knowing where I was. I don't think anybody would be interested"*. Another participant talked of her map, and flippantly remarked *"God you'd throw mine in the bin you'd be that bored."*

Other participants questioned the reasoning behind LBS tracking, and wondered why their movements would be of interest. The idea that LBS could potentially be useful to them was not a consideration: *"I don't go very far so it wouldn't worry me you know? I would just think, well why are you doing it? You know, what would they get out of it, tracking me?"* Another participant said *"The other thing is I don't think anybody cares where I am"*. These comments suggest that some participants did not consider there were potential applications of LBS technology for themselves.

Is it useful?

When thinking about the usefulness of LBS, participants could envisage it as a tool for other people: *"I can't see any use I would be making of it in my present situation."* Other participants agreed that at present, it did not seem of much use to them while they had *"command of all [their] faculties."* Many participants talked about not wanting to use LBS unless it was really necessary, or until they were really old.

However, the *potential* application of LBS was not overlooked, and participants acknowledged that it may be something they might use in the future: *"It just brought to my attention the fact that someday I might need something like that."* Some participants noted that it would be useful for people who were prone to wandering off. Participants recited anecdotes of friends who could benefit from this technology who lived in care homes. Other potential applications were practical, with one participant saying how she used to travel around in her car for work getting lost, and the LBS system would have been beneficial. It was also deemed useful in a scenario where friends would need to get in contact: *"Just supposing I hadn't taken my phone, I was an hour late, he could I suppose look and see where I might be."* One participant interestingly noted: *"It would be no use to me. Not unless I could get the results if I needed them."* This was the only instance of a participant considering that *they* could also have access to the information.

8.4.2 Who controls?

Who are the stakeholders?

A stakeholder or LBS provider seemed to be an unknown entity to participants. Participants did not consider *who* the stakeholder would be if they used LBS, but people were worried about trusting them, and other types of people. When asked about stakeholders, the main response was that their motives would need to be questioned: *"If you think their motives are okay then I have no problem, but it's the motives every time"*. Participants also expressed concern about where the information would eventually go, and who would see it: *"I'd want to know what the end product was, you know, why are you doing this? However you answered I hope would ascertain whether I thought that was slightly sinister."* Participants felt that the motives of the people who would ultimately be in control of their information were of most concern.

Stakeholder credibility/trusted people

Attitudes about stakeholders, or people who would manage the location data, were expressed in terms of who was or wasn't trusted. One participant described their lack of trust in the government: *"I don't know that I would trust anybody really on a large scale, when you think how the government have lost all these disks and things. Presumably they thought they had foolproof systems, which cost a lot of money. I think the human factor always comes in. Everybody's liable to forget something or lose something"*

Participants also felt that their information was at risk of being sold if it was managed by a company: *"I don't like that at all, because they sell information on and the next thing you're getting a load of letters"*. The feeling that unknown people could be managing their information was not approved of, and thoughts about trustworthiness were expressed: *"companies, if they were trustworthy... you just need one person and they can use that information in all sorts of ways can't they?"* If a company was to be trusted with data, participants hoped they would be *"someone with competent organisation and integrity"*. Interestingly, participants felt that Northumbria University was one of the only trustworthy institutions, and were happy for them to store information due to their ethical procedures in place: *"You folks took very specific precautions didn't you. I mean all the information I presume is kept in a safe place without proper names on"*.

Security/Data abuse/'Wrong hands'

Data security was of great concern to participants. Many talked of identity fraud and the measures they took now to prevent security breaches, such as shredding confidential material. There was a feeling that any kind of information could be at risk, and the existing problems with identity fraud could easily be applied to LBS: *"I don't mind having an identity card and so on, but all those things can be abused and lost. All the information and so on, get into the wrong hands. Those are the sort of worries I would have"*. The notion of risk differed for participants; some people were afraid of being 'conned', whereas others felt the technology might encourage people to follow them or physically harm them.

The phrase ‘wrong hands’ was often used when considering where location information might end up. Participants believed that potential harm was enabled by their information getting into the wrong hands: *“If they were wanting to harm me, it would give them the time, place [...] they could either hurt me or come into my premises”*

Imposition/Autonomy/Choice/Resignation

The notion of control was discussed at length by participants, and in particular, the idea that monitoring was already happening:

“I use a credit card when I go to ASDA and they know everything about me. They know my pattern of life and they give me vouchers because they see what I buy [...] I know why they do that, so they’ve got all that information. This [LBS] is just another method really”

Another participant complained saying *“They’ve all got it, I don’t care what you say. They’ll buy it off each other [...] there’s no such thing as secrecy”*. Participants were of the opinion that their personal details were already in the public domain, being bought and sold by different organisations. Feelings of resignation were commonplace, with many of the participants believing people already knew a lot about them: *“They know everything about you now, since the computers have come on nowadays”*. Computers were seen to be a major facilitator of this type of data abuse, with banks, supermarkets and marketing groups being the main perpetrators of extensive data collection. Some participants expressed concern that the introduction of LBS technology would interfere with their rights: *“I am a bit concerned about*

civil liberties, over the last few years, and I do think this idea of Big Brother is a little bit frightening".

Despite resignation about information being visible already, there was a realisation that they could try to control their location information: *"Well I would go [take part] on the condition that I could break it off or stop"*. When thinking about using LBS in the workplace, one participant explicitly said that there would be a need to know about being located. Others said they might be tempted to use the LBS system if they had a choice: *"I would like it to always be voluntary. I don't really like the idea of everybody having to do it"*. The idea of informed choice for vulnerable groups was also discussed: *"People who really need it [LBS] for their own safety, they're really beyond the point of giving voluntary consent aren't they?"*

8.4.3 Who sees?

Informational privacy

When asked who could have access to their location information, participants were generally only unhappy about it being divulged to strangers. However, some people felt that the *type* of information given out was important. One participant said they were happy to be located *"so long as my address wasn't on there"*. Another explained that *"As long as it can't be traced to me I don't mind who knows"*. This suggests that people did not want identifying information divulged, but anonymous information is not deemed valuable or worth protecting. Other participants said that for *"no particular reason"* their information should not be available to others. There were other participants who did not feel that their information being visible to others

was a problem: *"I take part in these [studies] perfectly willing for anything to happen to the information that's gathered"*.

Transparency- who has access?

Participants were of differing opinions about who could access their information, and how easily people should access it. There was a recognition that if strangers could not be trusted with their information, authority figures were equally as unknown to them: *"Somebody just off the street, no I don't think so. But I suppose a lot of people who, even if they were in authority, would be complete strangers"*. Participants also talked about the credibility of the people managing their information: *"somebody with authority but somebody who has the sense to realise I don't want it [information] given out to the world. Someone you can trust to do it"*.

Secrecy

Participants felt that location monitoring may cause people to become secretive. Behaviour that would have previously gone unnoticed would be of concern: *"I can see that for some people it could be 'right I'm switching this off cause I'm going to go and see my long lost son that my husband doesn't know about'"*. Another participant talked about court cases or adopted children as instances where you might not want people knowing your location. These types of behaviour were not used as examples of *their* concerns, but the participants believed for others the possibility of location tracking raised some issues: *"At my age I'm not conducting any illicit relationship. I'm not likely to be going to the STD clinic! I live a plain life, I can't think of anything I would do at my age. If I were young it might be a different matter altogether"*.

Participants seemed to believe that because they were doing nothing risky or secretive, it didn't matter who could have access to their information: *"It doesn't bother me because I don't do anything that I wouldn't mind other people knowing about"*. These ideas contrast with comments about Big Brother style monitoring and civil rights being waived.

The type of activities the participants engaged in also decided whether they felt secrecy was important. Some felt that trips to the supermarket or to see friends were so uninteresting that location tracking wouldn't matter. Alternately, one participant felt medical information was something you would be concerned about sharing: *"Say if you were worried about your health and you were getting investigations done. You might not want everyone to know"*.

Nothing to hide

Participants emphasised how little they felt they had to hide from anyone. Some described why there weren't worried: *"It wouldn't make any difference I mean I don't go to pubs and betting shops, but it wouldn't make any difference where I went or who knew where I was"*. Some participants felt that their age attributed to their lack of concern: *"I've got nothing to hide, I'm too blooming old to hide anything",* whereas some people felt that their daily activities or routines would be of no interest. Many felt that storage of their location information was not a useful exercise: *"If that information [...] is in the public domain I don't think it really matters because I don't do anything that really matters"*. It is interesting that people only saw LBS as useful if someone *did* have something to hide.

Who is trusted to see the data?

When thinking about who would be allowed access to their location information, partners, family, friends, police, carers, doctors, and caretakers were deemed the most suitable. Many of the participants stated that '*anyone with a legitimate cause for asking*' would be allowed to see their location information. Other people, such as a window cleaner, were thought of as people they "*didn't know well"*. Familiarity was a major indicator of trust for the participants. One participant stated that doctors, the police or family were strictly the only people allowed to see their location.

However, even with these trusted people issues still remained: "*I suppose you wouldn't mind your GP knowing, if it was about your health. Hoping and assuming they are trustworthy*". There were some instances of participants not knowing if they trusted an individual, but felt that it would still be of benefit if they had access to their location information: "*I wouldn't mind our caretaker here who keeps a bit of an eye on us knowing*". The mention of doctors, carers and caretakers as 'trusted people' perhaps reflects the social networks of the participants. These people are likely to be more trusted than a mobile phone or LBS provider, with whom the participants have little or no experience. This familiarity preference was demonstrated with participants agreeing that *"anyone researching, like yourself"* would be trusted.

The majority of participants discussed who *wasn't* trusted, or who would take advantage of a system that used location tracking. People were concerned about burglary, and the ability for others to see patterns in their behaviour. Strangers were a concern, and participants wondered why they would ever need to know their location: *"If he had no positive reason to have it, you know, if he wasn't emergency services or if it was just a gossip shop, no. Take a walk, a long walk"*. The idea of a

trusted person was not unanimous, with one participant saying *"I think I might feel a little bit intimidated if the police had the information. Got mixed feelings about the police really"*. Other participants felt that police were one of the organisations that would undoubtedly be granted access to the LBS system.

Patterns of behaviour/vulnerable to crime

Participants were aware that someone tracking their whereabouts may leave them vulnerable to crime. The main concern was theft from their property, and the worry that if they left the house people might use the opportunity to break in. One participant pointed out that "*if it's somebody who has a regular life, doing the same things every day, then you've got a pattern. That's it, you're vulnerable straight away*". The idea of routine was of concern to a lot of participants. Another described her routine as "*Tuesdays and Saturdays, it's dialysis. Wednesday is rest day. Thursday is the garden. You know I've got such a pattern, it never alters and it would be picked up*".

Participants also recognised that they were a vulnerable group, but often did not really know *who* would want to exploit their location information: "*If anyone was criminally minded or after some information, particularly maybe if you're old or older than I am now, and maybe not quite with it. That might endanger you. But I don't know from who, to be honest. Unknown persons*".

Exploiting the LBS system was a recurring theme, with one participant saying "*If you make it possible for someone to buy the equipment to monitor their Alzheimer's husband, with a few lies, it would be equally available to someone who was thinking about doing a bit of breaking and entering*". Others mentioned news reports of

people being followed and attacked, and in general felt that the system could be used for bad as well as good.

8.4.4 Who benefits?

Context

When thinking about who could benefit from using LBS, participants discussed the problems associated with old age, and benefits that it could have for them and their families. Participants realised that the automaticity of the device meant if they went missing, their family could locate them instantly: *"Just suppose anything happened to me [...] nobody would know who I was. Now if I had that [LBS] on me at least if anything happened somebody would know where I was"*

The idea of LBS being beneficial was often only considered in a future context, either if participants would become immobile, or if their mental state were to deteriorate: "*If I were in need, if my mind had gone, I wouldn't mind because it would be far less trouble for the children. If they were to ring up and say 'oh mother has vanished, we think she's so and so', that's fair enough*".

Participants also considered using LBS in a work context, and hypothetically viewed it as a useful tool for management to monitor staff: "*I think we all need a certain amount of supervision. I think we all work better if we know we're accountable to somebody. If you're left an entirely free agent I think the best people could take a few liberties*", or in terms of sharing with colleagues: "*This would apply much more when I was younger and at work. I would have no objection to my work colleagues knowing where I was, when I was*". In a work situation, their concern focused on

people misbehaving, rather than any personal safety applications. Despite being retired, participants felt that use of LBS in the workplace was concerning and should only be used if the individual was aware of it. Another suggested that the use of LBS at work raised *"all kinds of moral questions*".

Physical safety

Participants acknowledged that being older made them more vulnerable when going out alone: "*You do consider safety a lot more at my age than younger people do. You're looking at paving stones all the time in case there's one going to trip you up*". Participants could see the benefit of using LBS, primarily to maintain a record of their whereabouts in case anything happened: "*If something awful happened to me, you can look at this and see that I was in Whitley Bay that day [...] so personal safety I would say it could be a bonus*". Participants realised that the alarm system associated with LBS systems could promote safety. However, they did not necessarily consider that *they* would be the person requiring assistance: "*people in their houses, if they have a fall they can press a button and get somebody*". Some, however, felt that using LBS as a precaution was wasteful: *"it would cost a lot of money for nothing. It is for something that might happen".* The pre-emptive measure was not deemed worthy of the financial costs associated with it.

Vulnerable people

Participants could easily envisage that certain people would benefit from using LBS: *"If you're wanting to keep track of someone, whose mind's going a bit, I think it's a good idea".* In line with the literature, issues of consent were considered when discussing people with problems such as Alzheimer's: "*Well I don't know, I think I*

would probably feel comforted if I was vulnerable, but would I know I was vulnerable?"

Many participants recounted stories of their friends who had gone into care homes, and who were frequently found wandering: "*Anyone who does wander off can cause an awful lot of hassle and trouble for those who are caring for them. I've known several people who wander off and when it's discovered they're not in their room there's panic stations!*" One participant even discussed how the use of LBS with Alzheimer's patients would be akin to the practise of 'tagging' criminals, in order to ensure that the LBS device would be with them at all times. On a more pragmatic level, some felt that using LBS would not stop people getting lost, and there would always be a danger: "*We've all heard about some old lady that goes wandering off from the care home and 3 days later she's in a snow drift. That happens every year and it will continue to happen*".

Anxiety reduction/reassurance

Although many of the participants did not feel that the technology would keep them any safer or be overtly useful, they did feel that just having the tracking device with them would be a reassurance for them and their families. One participant said "*You might sort of think oh well at least somebody knows where I am*". Some of the participants felt that because they lived alone, it would be a comfort to know that people knew where they were. Others felt that using LBS would provide some comfort in the face of sudden ill health: "*Well I suppose if you're going to have a heart attack or something, you'd be quite glad*". Participants emphasised that this

kind of system would only be of benefit if it featured an alarm button which could be pressed in case of emergency.

Finally, participants did feel that the reassurance the LBS technology might provide would require a trade-off with privacy. One person stated "*You might feel a bit more secure, but you might feel a lack of privacy*". Another participant emphasised that the value of using the technology should and would outweigh the risks associated with it.

8.5 Discussion

The aim of these interviews was to establish whether LBS technology could be used successfully with older adults, and how they perceived their experiences of it. In part, participants were given the opportunity to reflect on their previous trial with the technology, but the interviews also explored their perceptions of usefulness, feelings of safety, and the usability of LBS technology in general. Analysis also aimed to uncover any particular situations that would encourage or hinder use of LBS for this population.

8.5.1 Problems associated with LBS

Participants often felt that their information was liable to be lost, stolen or abused by people in authority, with the only trusted organisation identified by them being Northumbria University. This trust in the university may be due to their perceptions of other organisations being untrustworthy, but their contact with staff and researchers during the trial will have provided reassurance. From a business perspective, knowing that greater familiarity may encourage greater trust is important. Certainly a lack of understanding about stakeholders or LBS providers

meant that older adults were less trusting of them, as well as less knowledgeable. In terms of managing their information, participants echoed a sense of resignation that has been identified in other older adult research (Melander-Wikman, et al., 2008).

One major issue was the level of participant understanding about how LBS could be beneficial to them. The research they were involved in prior to these interviews was not used as an opportunity to promote the technology; the only experience of LBS that participants had was on a trial basis. There was perhaps a need to emphasise the potential use of LBS with older adults, as opposed to it being perceived as a university experiment only.

8.5.2 What could encourage LBS use?

Participants did not explicitly see the advantage of using location-based technology, as they had alternatives they felt more comfortable and familiar with, such as telephoning a relative or writing their movements in a diary. Many expressed difficulty using the technology during the trial. Some participants explicitly talked of usability issues and problems they experienced. Research has suggested that ease of learning and use is important when considering older adult acceptance of technology (Renaud & Biljon, 2008). This needs to be addressed when considering trials with older adults. They need time to become familiar with the technology, which in this case may not have been long enough or suitably detailed to allow them to feel competent.

One reason participants acknowledged that they would use the technology was if they became vulnerable, or if their physical or mental health deteriorated. Participants acknowledged that if they had an accident away from home, the LBS

system would help them. Similarly, feelings of reassurance were expressed, simply by having the LBS technology. However, participants did not feel it would explicitly keep them any safer.

One interesting finding is the hesitation of participants to use the technology until it was needed, when they felt they were *really* old. This strive to maintain independence is encouraging, but highlights that perhaps acceptance of this technology is perceived as 'giving in', rather than providing an opportunity to enhance their lives. Again, greater promotion of the capabilities of LBS, and emphasis of its use for any population would be beneficial. Research has shown that devices which stigmatise the individual are not favourably adopted (Giusti, et al., 2010). It should also be emphasised that the older adult group were not chosen because they were vulnerable, in poor health, or in need of assistance, but because they were a healthy group who may benefit from this technology.

8.5.3 What is not considered?

The notion of 'who takes responsibility', a theme from the guiding framework, didn't emerge in these interviews. This theme relates to who is accountable for the technology malfunctioning, or if the information gathered is of poor quality. Participants were not clear about who would potentially be a stakeholder, and less understanding of the role they would play when managing information. Responsibility of information management for the participants was often preferred to be left with family members or existing trusted authority figures. However, familiarity with 'stakeholders' is something which should be considered when using any kind of new technology which collects personal information. The literature

suggests that with the advent of data loss and information being sold, LBS providers must be responsible and accountable for security (Rao & Minakakis, 2003). A deeper understanding of data management procedures may encourage older adults to think more positively about information storage and safety procedures.

It is interesting that the older adults were much better at identifying how other sections of the community may use LBS, but in general they could not see how LBS would benefit them. There was also an overall feeling of 'why would anyone want to collect my location information?' The wealth of literature documenting existing LBS use with older adults suggests that it can benefit an older population, however research is focused on use with dementia patients rather than the older community in general (Essén, 2008; Landau, Werner, et al., 2010; Melander-Wikman, et al., 2008; Müller, et al., 2010).

8.6 Chapter summary

Research into the use of LBS for older people with cognitive disabilities is growing, and the perspectives of older adults are important to understand. These interviews with older people suggest that an LBS application is viable, but concerns need to be addressed. Trust of others in general was low, and this impacted on levels of trust using LBS. However, there were positive perceptions of the LBS system, suggesting that in principle, the older adults were not averse to using it.

CHAPTER 9: LBS USE WITHIN THE FAMILY

The interviews with older adults discussed in chapter 8 suggested that trust of others impacted on attitudes towards LBS. However, participants also felt that people who were vulnerable or prone to wandering may benefit the most from location-tracking. This chapter explores how LBS may be able to assist parents in locating their children. Parents regularly use mobile phones to stay in touch with their children, but developments in location-based tracking now allow parents to monitor the location of their child directly. Such location-based services offer new assurances, but also bring new privacy challenges. In order to explore these issues, a case study was conducted which focused on the way a family used LBS technology to keep track of their teenage son who had Aspergers Syndrome and Attention Deficit Hyperactivity Disorder. This novel research adds to the previous qualitative findings described in this thesis, and shows that LBS can be effectively be applied to other user groups, and provide numerous benefits to them.

9.1 Parent-child communication

An essential part of being a parent involves knowing where your child is, what they are doing and who they are with. According to a survey of UK school children, 82% of 12 and 13 year olds now report owning a mobile phone (Clark & Dugdale, 2009). Approximately 75% of teenagers in the US are said to own a mobile phone, often purchased by their parents in an effort to stay connected to their child (Rabin, 2011). However, research suggests that information gained by parents most often comes from what the child tells them, not from parental monitoring (Stattin & Kerr, 2000). Yet Stattin and Kerr emphasise the importance of monitoring in order to reduce the

probability of behaviours such as alcohol and drug use, risky sexual behaviour and delinquency.

With the advent of mobile phones, it has become easier for parents to be aware of their child's location; they call them and ask where they are. Yet this instant communication tool is not always used as it was designed. In one study of mobile phone use in the Czech Republic, teenagers spoke of deception or ambiguity when receiving unwanted calls from their parents, either saying their phone battery had run out, they had no signal, or had no credit (Vykoukalová, 2007). Research has also shown that a greater frequency of parental calls leads to less adolescent truthfulness (Weisskirch, 2009), suggesting that parents should establish norms of expected communication which could enhance the parent-adolescent relationship.

The impact of mobile phones on the family unit has often been explored qualitatively, and research suggests that issues of safety, surveillance and privacy are taken into consideration in a family context (Devitt & Roker, 2009). During interviews with 60 UK families, teenagers reported feelings of independence and flexibility using a mobile phone. They felt a sense of added safety and peace of mind, and acknowledged that it was a reason their parents allowed them to go out more. From a parent's perspective, mobile phones were seen as a tool to help organise family activities, and enable what was termed 'essential communication'.

Safety and well-being are often cited as reasons for mobile phone contact with teenagers (Vykoukalová, 2007). Parents feel that the phone is a safety precaution and teenagers could telephone them for help if needed. However, mobile phones have also been perceived as a way to enable teenagers to plan activities without parental

knowledge or approval. Overall, the mobile phone has been seen as a positive tool, believed to encourage independence and safety for teenagers. Research suggests the benefits outweigh potentially negative implications such as phone bullying and theft of mobile phones.

9.2 Family monitoring

Technology is now used as a trusted tool to ensure child safety, with parents using mobile phones more often to communicate with their children. Research has shown how the use of mobile phones allow an extension of 'home', with the parent being the base and a phone allowing children to go beyond the physical boundaries of the house. Mobile phones have been perceived as integral to parenting and viewed as a method to 'keep track of everybody' (Palen & Hughes, 2007, p. 343).

Technology has also been suggested for the monitoring of young children using LBS- researchers developed a prototype 'virtual leash' for a young child (Marmasse & Schmandt, 2003). This was designed using a mobile phone with in-built GPS, which allowed a parent to specify where their child is allowed to roam. If the child goes further than the prescribed zone, an alarm alerts both parent and child until a more appropriate distance is achieved. Investigating the likelihood of sharing locations using LBS, researchers have found a greater perceived usefulness amongst parents compared to non-parents (Tsai, Kelley, Cranor, & Sadeh, 2009). After experience of the technology, parents and non-parents felt the same way about the usefulness of LBS, yet parents still felt they would be more likely to use it in the future.

Qualitative research exploring the use of location tracking within families has suggested it 'affords a means of *digital nurturing*' (Boesen, Rode, & Mancini, 2010, p. 65). As Boesen et al. note, much of the LBS research has focused on hypothetical scenarios or short-lived trials. Their research focused on families who had already voluntarily been using LBS technology. Concentrating on four UK households, the researchers identified key themes which accounted for LBS use: a desire to try out new technology (a predominantly male trait), a desire to monitor for safety reasons, a desire to reassure oneself that the family is safe, and to satisfy curiosity about family member's activities.

In terms of LBS applications with adolescents, research has shown that a GPS-enabled mobile phone can be an effective and feasible method to monitor location (Wiehe et al., 2008). Their study aimed to discover where adolescents really went, with the ultimate aim of preventing risky behaviours such as underage smoking. As research has shown teenagers are not always truthful, especially with parents, and LBS technology offers the opportunity for accuracy. With the consent of 15 female adolescents, mobile phones were used to track their location over a period of 7 days (Figure 9.1).

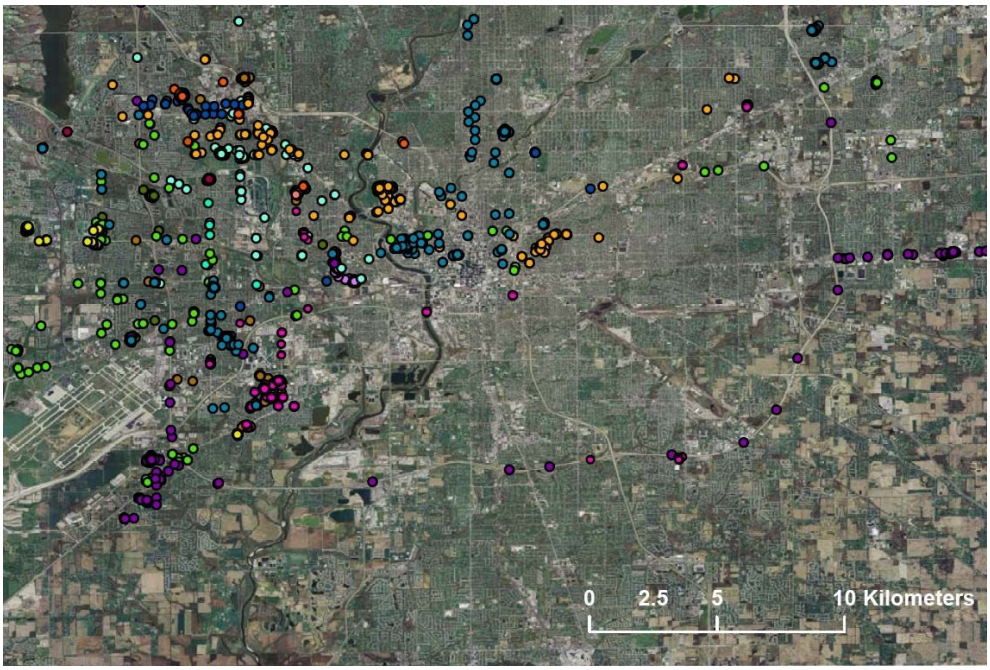


Figure 9.1 Aerial photograph of teenager GPS data points (Wiehe et al. 2008)

Interviews suggested participants were not concerned by the GPS tracking, nor did they feel the study altered how they behaved. Some participants (and their parents) described feelings of safety when using the technology, yet others said friends felt threatened that calls or location activity would be reported to the police. Participants used the phone capabilities to their advantage, with internet features helping them to navigate when lost. The researchers described tracking of adolescents as potentially a more acceptable and accurate method of evaluating their behaviour.

9.3 LBS use and disability

The research summarised so far highlights how technology can help parents to monitor their children's location. This type of technology would be especially useful for parents of children with varying cognitive or social deficits. More recently there has been an increased understanding of the ways in which technologies might bring

some improvement into the lives of those with psychological disorders. For example, collaboration between software specialists and medical professionals showed how a 3D computer game could be developed to aid communication between adolescents with mental health problems and their therapists (Coyle & Doherty, 2009).

Research has also shown that technology can facilitate the execution of everyday activities for people with psychological disorders (Carmien et al., 2005). Typically travel, transport and navigation can generate problems for individuals. Looking at ways to improve navigational skills on public transport, Carmien et al. suggested an electronic assistant to aid way finding. A 'Personal Travel Assistant' was designed to be a prompting device, enabling the user to navigate and use transport without external intervention. However, researchers have noted the importance of the technology fitting in with the lives of its users. Interviewing families with a disabled child, issues have been raised relating to the suitability of the technology and whether it matched individual needs (Dawe, 2006). The parents often struggled to understand the technology, whereas in some cases the children became expert users. In particular, independence was found to develop for some children but not all.

These research findings emphasise the independence that technology *could* provide in a family setting. To date, LBS have not been specified as a tool to help people with psychological disorders. Similarly, relatively few studies of LBS have considered social and family contexts; those that exist are predominantly focused on a parent's need to understand where their child might be (Dishion & McMahon, 1998). In this study we explore the potential use of LBS in a family setting where pressures on the family arise because of their son's psychological disorders, namely Aspergers Syndrome and Attention Deficit Hyperactivity Disorder (ADHD).

9.3.1 Aspergers and ADHD

ADHD is characterized by atypically high levels of hyperactive/impulsive behaviour and inattention. The different stages of ADHD and their disruptive potential are described in Figure 9.2.

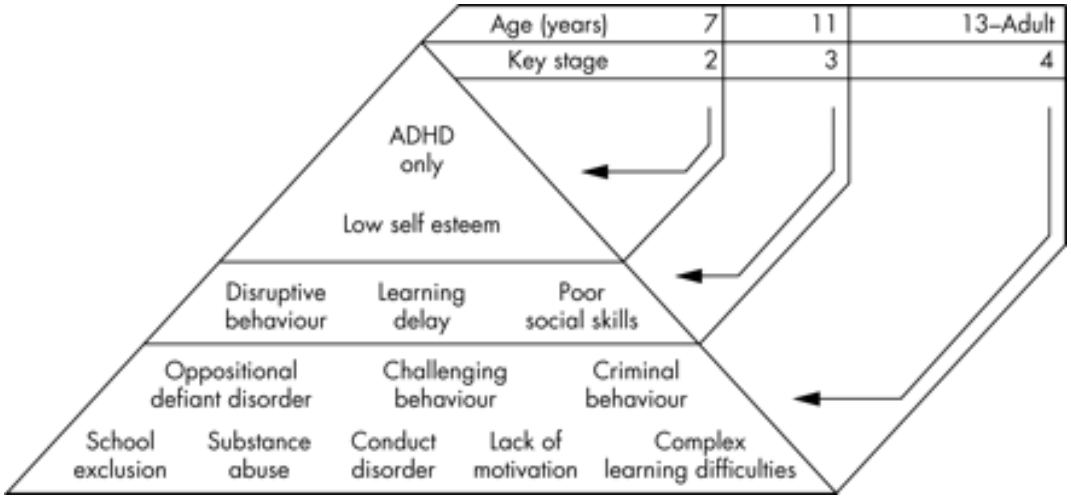


Figure 9.2 Impact of ADHD at different stages (adapted from Kewley, 1999)

The Diagnostic and Statistical Manual (DSM-IV, 1994) criteria for Aspergers Syndrome includes impairment in social interaction, restrictive, repetitive and stereotyped patterns of behaviour, and significant impairment in social, occupational, or other important areas of functioning. Adolescents with Aspergers Syndrome have been identified as a subgroup in particular need of support, as these young adults frequently experience low self-esteem and have to deal with a range of health concerns that can include depression and anxiety (Stoddart, 1999). Both ADHD and Aspergers have different symptoms, however the social and family impact on the individual with these psychological disorders is of most relevance in the case study reported in this chapter.

9.4 Method

9.4.1 Participants

Participants were two adult parents (1 male, 1 female) of a 16-year-old male with ADHD and Aspergers Syndrome, all of whom had experience of using LBS. There was a younger teenage son within the household, but he was not involved in the study, and had no behavioural problems or experience of LBS. Also present for the interview were two employees from the Digital Challenge Programme, a partnership of public, private and community sector organisations linked with Sunderland City Council, UK. This organisation set up the LBS trial for the family, and the employees were present in order to gain an understanding of their intervention. The family had been using the LBS system, provided by Trackaphone, for approximately 4 months. The pseudonym 'Steve' is used throughout the transcript to refer to the teenage son.

9.4.2 Materials

The parents and teenage son were each given a BlackBerry mobile phone running a Trackaphone LBS platform. The Trackaphone People Locator system was set up throughout the trial. This system enables a person to locate an individual instantly using cell ID. The system also included Alert Client (see Figure 9.3). Alert Client enables escalation procedures and panic buttons to be used in the event of an emergency. This system allowed the parents to be alerted to these alarms if triggered by their son. This aspect of the Trackaphone software differs greatly from commercially available services such as Google Latitude, which have no alarm system or inherent safety features.

Figure 9.3 Alert Client: Red Alert, Amber Alert, Delay Amber, Cancel Alert

The Blackberry was also configured to allow the family to make and receive phone calls as normal. This equipment was offered to the family for as long as they wished to use it, and at the time of interview there were no plans to return it to the vendor.

9.4.3 Developing an interview schedule

A semi-structured interview schedule was developed to be used with participants (see Appendix 11.16). This interview was conducted with consideration of the factors which feature in the revised LBS model described in chapter 5 (perceived usefulness, trust, and disclosure issues). However, these factors which predict LBS uptake in the workplace may not be relevant to the uptake of LBS under the somewhat unusual family circumstances described here. However, there have been no other research frameworks that address the way that LBS can help families, or challenged families in particular. It was not the purpose of this case study to test the new model directly, but the factors were considered during analysis. The questions asked during the

interview were designed to understand more about the way the LBS system was used in the family, and implications for other areas of their life.

9.4.4 Procedure

The participants were told this research was intended to be an exploratory case-study investigating their attitudes and experiences of using LBS within their family. The interview was carried out at a neutral location, and took approximately two hours. Participants were allowed to talk at length, and prompted when necessary. The interview was tape-recorded with permission from the family, and then transcribed verbatim. The resulting transcript was read, re-read and coded using thematic analysis. Coding was partly driven by the factors based on the model, but was not restricted to them. Codes were then organised into themes. To aid the coding and theme organisation, NVivo 8 qualitative software was used.

9.5 Results

Thematic analysis produced seven key themes. These are discussed below and summarised in Table 9.1.

Table 9.1 Themes and codes identified from the family interview

Theme	Codes
Navigation	Notion of zones, Way finding, Routine, Being Lost
Anxiety	Deception, Stress, Parental Concern, Money
Well-being	Reassurance, Trust, Safety, Privacy Vs. Safety
Personality changes	Distraction, Behaviour Without Medication, Getting In Trouble, Communication
Personal Development	Confidence, Encouraging Independence, Increased Boundaries, Helping Others
Freedom	Child's Freedom, Parent's Freedom
Technology Adoption	Respect, Usability, Reciprocal Tracking

9.5.1 Navigation

The parents discussed at length the problems with their son's navigational skills which caused him to frequently get lost. They talked of driving around in the car looking for him before they had the use of LBS: *'Basically he used to go out and not come back. We had to go out and look for him.'* The parents emphasised the benefit of using the Blackberry which enabled them to pinpoint where their son was, and save time searching for him.

Previously this habit of getting lost impacted on the places the family allowed their son to go to, resulting in a restricted routine for him. Before using LBS, Steve's routine mirrored that of his younger brother, who he used to copy to ensure he got home safely. The family discussed problems with their son not coming home when he should, but since the implementation of LBS they described how he was developing his own psychological as well as physical 'safety zones' in which he could travel without fear: *'It's like it's (LBS) expanded his zones but he looks at that as a safety net as well. It's kind of a comfort zone isn't it?'*

The LBS system encouraged him to take notice of where he was, and knowingly plan where to go himself: *'He's starting to plan his route, that's what he's doing. He's planning ahead, whereas normally we have to plan ahead for him.'* Planning routes was previously extremely difficult for Steve. Therefore utilizing this technology, providing exact location information both to him and his parents, helped Steve overcome his previous problems. He was said to be able to self-manage, in part by sticking to routines. The LBS system, in this case, provided both location-aware and location-tracking services that parent and child found useful. For Steve, LBS were used to pinpoint his own location, whereas his parents used it to track him and navigate their route towards him if lost.

9.5.2 Anxiety

Prior to the introduction of the LBS system, the parents experienced immense stress when their son went missing. They described this as a constant worry, with stress reactions for his mother including vomiting, weight-loss, and a reluctance to leave the house: *"With me vomiting all the time and the stress and everything, I was losing*

the weight and I wouldn't leave the house for him because I knew he'd come back either by the police, or I'd have to look for him." The family noted that Steve's disability meant he was often falsely accused of bad behaviour, or blamed for things he hadn't done. The LBS system would store location information for three months, and this record allowed him to be absolved of blame, resulting in less anxiety for his parents.

Any change in Steve's routine was likely to trigger stress reactions. His parents acknowledged that an upcoming change in school would previously have been a major concern, as well as Steve eventually going to college. However, stress was not eased by Steve often being deceptive. His parents said previously he would lie or withheld the truth about where he was going, but the introduction of LBS meant that he was readily located. For example, Steve's mother discovered he had avoided a swimming lesson when she observed he had taken his Blackberry out with him: *"I think that's why I did have that instinct. I thought he's taken his swimming trunks and a towel, and he never takes his tracker [Blackberry]. I was sitting in the garden and thought 'I'll just check where he is."* With an understanding of Steve's routines, his mother realised he was not where he was supposed to be, and use of the LBS system simply confirmed this suspicion. As a by-product, the introduction of the LBS system caused Steve to be more truthful, or rather, it convinced him that deception was pointless; he realised he couldn't effectively deceive his parents about where he was going.

9.5.3 Well-Being

The LBS system provided reassurance for the parents, encouraging peace of mind: *"We look at it occasionally [...] it's good for your peace of mind, you know when you get that feeling"*. Steve often worried they would not be able to find him: *"I had to reassure him, but he felt safe knowing that I'd find him."* He also acknowledged the value of the technology for his family: *"I've asked Steve does he mind being tracked. He said 'well I know everybody knows I'm safe."*

The use of the system also seemed to slowly build up a new kind of trust between parent and child. Steve's parents discussed how they used to accuse him of things because they had no way of knowing where he had been. The technology meant the doubt was eliminated. Steve also learned when he needed to take his BlackBerry out, and realised its benefit: *"He still has kick offs and major disruptions, that's Steve, but with the Blackberry he's like, I think it's a trust. He's learning to go that far and be trusted and he's more relaxed when he comes back. He's thinking well I'm able to do it. And it's not a constant battle against each other."*

Both parents said the technology generally made the family feel safer, but also talked about applications for the technology to ensure safety in wider society: *"If you were to offer this to people and say well listen you can have Trackaphone but it's gonna cost you £1.50 a week for a child, millions of people would take it."* Safety was viewed as being of more value than privacy in the case of children. The parents explained that they were not worried where their son was at every minute of the day, but would use the system occasionally at their discretion to maintain safety: *"The thing about privacy really is, it's not like we're sitting at home in front of a computer*

and we track every move he makes. We look at it occasionally, it's like 'right, I wonder where he is'. That's it."

Steve's father believed that if PINs or passwords were put in place, the LBS system could benefit other families with at-risk children. He also mentioned a number of high profile abduction and murder cases, which in his opinion, could have been avoided if parents were offered the opportunity to use this technology. Interestingly the family agreed that the usefulness of the system would eventually be outweighed by a need for privacy, and at the age of 18 their son would possibly not want to use the system. However, there were limited privacy concerns for the immediate future: *"Well privacy shouldn't come into it when it's your child. I mean, it's a two way thing isn't it. We know where he is, he knows where we are. And if you've got to hide something, that's the only thing you'd be worried about."* In relation to their other more streetwise son, the parents described their unpopular suggestion that he borrow his brother's LBS system when he went out: *"I said 'you can take your brothers tracker out with you if you're going out'. He said 'you've got no right tracking me; it's up to me where I am'."* There were clear differences in the perceptions of this technology for the family, with the more vulnerable son accepting he would benefit from it, whilst the younger more independent son felt it may invade his privacy.

9.5.4 Personality changes

Prior to using the technology, Steve's parents said he would become distracted and get lost after following somebody. His disorder also caused problems with simple tasks such as brushing his teeth or putting shoes on. With the adoption of LBS however, they reported that he was thinking for himself more: *"He'll get his shoes*

but he doesn't put them on his feet. You've got to input all the time whereas he thinks for himself with this (Blackberry)." His increased independent thinking and behaviour changes also impacted on his medication dosage: *"Yeah, the medication's slowly going out the window [...] whereas before we would have to make sure he took it to concentrate."*

With the development of initiative and the realisation that his parents were giving him more freedom, the technology was said to help communication between parent and teenager. The BlackBerry provided Steve's parents' with instant verification of his whereabouts, which Steve actively began to use to let his parents know where he was: *"He went 'I've missed the number 3 bus, I'll be back home in about 45 minutes' [...] I didn't even expect him home. But he must have just panicked and thought 'I'll phone me mam'."*

9.5.5 Personal Development

During Steve's use of the LBS system, his parents reported that he developed a noticeable growing confidence: *"But I mean his confidence, he's gone into a normal teenage lad that he should have been when he was 12 or 13. I've got two teenagers."* His parents also talked of Steve feeling empowered when he had the LBS system. This confidence led him to become more independent; he was able to go out alone without fear, use public transport, and visit friends: *"With this [Blackberry] I haven't got to be there 24/7. He's started doing everything his self. He's starting to think for his self a little bit better."*

The family talked of Steve pushing boundaries and expanding his social network: *"He's getting overly confident now. He's thinking well I've got the phone, I'll be*

fine. He's come to rely on it, and he's feeling really empowered by it, especially expanding his own boundaries." This change in behaviour still carried an amount of risk, and his parents hinted that they occasionally worried and would check his location. In general, however, the risks associated with giving Steve more freedom were outweighed by the benefits of his personal development. This development was linked with trust; his parents acknowledged that he needed to be trusted to go out and come back on his own.

The LBS system also enabled Steve to adapt his behaviour. He became more observant and aware of his own surroundings. He also learned how to deviate from pre-existing routines to suit his mood. This growing trust and independence was encouraged to prepare Steve for college; his parents wanted him to be self sufficient and able to cope travelling alone. Steve not only accomplished this with use of the LBS system, but also became an aid for other students travelling to school on the local bus.

9.5.6 Freedom

The use of LBS brought new freedoms for Steve, but also for his parents. They said Steve was getting more of a social life, he was allowed out more during school holidays, and spent more time with his friends and wider family. These new activities made the parents feel redundant, but encouraged them to change their own routines. The reduction in worry meant that his parents could go out together. There was a sense of re-learning how to spend time together and develop as individuals: *"We've started to do things together, whereas before it used to have to be separate, one of us*

went out, one of us stayed in. I'm going on courses now which I couldn't before because I wouldn't leave him [husband] with all of it."

9.5.7 Technology adoption

The technology was adopted well by the family, and only on a few occasions did it cause the mother to revert to old methods of communication: *"There has been one time when he's [Steve] pressed the alert button, and I've panicked and phoned his mobile. And that's my quickest way. Because by the time I've remembered my PIN and put the PIN in I panic, as a mother does, I just panic."*

Steve developed an affinity with the technology, and often guided his parents when they struggled to use the BlackBerry. One result of these technological capabilities was Steve tracking his parents when *they* went out. This gave peace of mind to both parent and teenager, so they could leave him at home without worry. Such reciprocal use of tracking technologies is particularly interesting in the way it can alleviate power imbalances and help to address privacy. Unsurprisingly, Steve's parents expressed the view that privacy concerns were less important than safety concerns – but reciprocity in the use of LBS to track both parent and child meant that loss of privacy worked both ways.

Steve also demonstrated a respect for the technology, understanding that it was the reason he was being trusted and given more freedom, and showed sense in sharing it with others: *"He doesn't take it to show it off to his friends or anything, or text in front of them. He has taken it out when he's needed it, phoned his emergencies, then put it back in his pocket. Cos you'd get some kids 'oh I've got a new phone'. He's not like that with it. He knows it's his independence."*

9.6 Discussion

This case study has provided some important insights into how LBS might be introduced into the lives of families with children who have psychological disorders. The main themes discovered here related to two aspects of family life; first, the impact that behavioural problems had on the family before LBS use, when the teenage son would become lost, get in trouble, and lack concentration. The second aspect which became clear was the way the LBS technology impacted on the family as a whole, and improved not only navigational problems, but more interpersonal family relationships also.

The first thing to note is that, understandably, the themes that emerged in this study were different from those that dominate the existing LBS literature. Perhaps the key difference is the emphasis on privacy, which is generally considered one of the key factors in predicting uptake of LBS services and was a major factor in Junglas and Spitzmüller's model. These findings say relatively little about privacy – but this is to be expected in a study that places the family at the centre of investigation. Within families in general, and this family in particular, children's privacy needs can conflict with parents' responsibilities. For this particular family, parental responsibilities have become burdens, tied to acute anxieties that have since been alleviated by the use of an LBS system. The parents did recognise the need for a teenage boy to be able to have a private life of his own, but privacy violations were accepted as a reasonable price to pay for peace of mind. On reflection, privacy management may not be of paramount concern in the design of a family-based system, where the parent will assert their right to protect their own child.

The lack of privacy concern from the family also impacted on the lack of concern about an LBS provider, or management system. Whilst this is not surprising either, the way in which the technology came to be used in the family may explain this lack of concern. Before the trial, the family attended a local support group connected to their local council, and were identified as being eligible for assistance. The council then offered to trial the LBS system with them. There was no contact with Trackaphone, the LBS provider, rather the family's experience of management was through council intermediaries. They built up a trust and friendship with the family, exemplified by their attendance at the interview.

Existing LBS work, and particularly the revised LBS model described in chapter 5, places significant emphasis upon the perceived usefulness of a system. In the current study, not only did the LBS system prove useful in enabling Steve's parents to locate him instantly (the initial aim of the system), but it also succeeded in a more fundamental goal: that of giving both parent and child more freedom. In this family context the system proved useful to the parents, who were able to socialize with friends and go out more, whilst the teenager gained in confidence and was able to spend more time away from home. In other words, the use of the LBS system led to a significant growth in personal development and improved well-being for all family members. This kind of improvement has been reported in other studies of family LBS use, with peace of mind and development of trust enabling more freedom (Devitt & Roker, 2009). Such significant added value is not something usually associated with an assessment of the 'usefulness' of an LBS system.

This case study raises interesting questions about the value of LBS in different contexts. It is also important to note that use of LBS within this family had a positive

impact, but the technology may not improve conditions for all families with similar problems. However, the technology may have been used more as a bridging tool, encouraging behaviours which would not have normally developed without it. The reliance on the technology was short-lived, and the family talked of slowly reducing or even stopping use of the technology in time. However, the positive changes for the family which were practised and learned could be maintained without technology. This study has shown that away from the workplace, the introduction of LBS can prompt fundamental changes in respect of autonomy and freedom, personal responsibility and growth, peace of mind and psychological wellbeing.

9.7 Chapter summary

This case study describes the introduction of LBS technology into the life of a family with a very challenging child. This case is not typical of other LBS contexts of use found in the research literature, yet the study reveals a remarkable success story for LBS in terms of improving the quality of life, wellbeing and confidence for a family. This case study is instructive in three important ways: firstly, it allows us to redraw the parameters for uptake of LBS, moving research away from workplace or telehealth applications; secondly, it allows us to question the conditions under which LBS might be successfully employed, particularly in terms of privacy requirements; and thirdly it allows us to redefine the goals of LBS, expressed not simply in terms of 'useful' or not, but in terms of more fundamental human values.

CHAPTER 10: DISCUSSION

This discussion considers the findings from the six research chapters reported in this thesis, and highlights the main contributions from each to the understanding of LBS. The work is summarised in terms of the research aims and objectives: firstly, the way in which a hypothesised model to predict intentions to use LBS was tested and revised to produce a new model; secondly, the conclusions from research focusing on disclosure, and different context of use for LBS. The literature described in chapters 1-3 will be reflected on, and in particular, how the work documented in this thesis has added to our knowledge of LBS. Recommendations for industry as well as workplace LBS initiatives will be suggested, and finally, considerations for future research will be explored.

10.1 Research aims

The purpose of this research was to improve our understanding of LBS technology. In particular, this thesis aimed to fill gaps in the literature regarding the perceptions of LBS from a user perspective.

The research aimed to answer two main questions:

1. What predicts LBS use, and what role does privacy and disclosure play?
2. What different contexts affect attitudes towards LBS use?

The first research question aimed to predict intentions to use LBS with a tested model. Junglas & Spitzmüller (2005) devised a model to predict intentions to use LBS; however this model was not formally assessed. Previous research has also suggested the important role of privacy and disclosure when using LBS (e.g.

Benisch, et al., 2010). However, an understanding of the ways people may categorise location information, and the disclosure preferences they hold for different groups had been overlooked.

The second research question aimed to address the way that LBS could be used in different contexts, and to explore the attitudes that people may hold about this technology. Privacy concerns, and in particular the use of location tracking in environments such as the workplace, have caused this technology to be questioned by the lay person. Whilst contentious issues such as using LBS to track criminals or monitor employees at work are prominent, the rise of social networking sites have also brought the use of LBS into public consciousness. With an ever increasing capacity for people to utilise LBS, the research literature has lacked a detailed exploration into people's attitudes towards it.

In order to answer the first research question, a model to predict intentions to use LBS was tested, based on the Junglas & Spitzmüller (2005) framework, using a questionnaire. This model was refined based on the questionnaire data, and resulted in a new model to predict intentions. To understand disclosure preferences, a concept elicitation and card sorting task were conducted in order to identify what types of information people were willing to disclose, and who the recipients of that information would be. In order to assess different contexts of LBS use, three case studies with distinct user groups were conducted: a lone worker, older adults, and a family with an ADHD child. The ways in which these two research questions have been answered in this thesis are discussed in section 10.2 and 10.3.

10.2 What predicts LBS use?

The first two studies described in chapters 4 and 5 had the aim of developing a new model to predict intentions to use LBS, based on a revision of Junglas & Spitzmüller's 2005 model. The items in their model included technology characteristics, task characteristics, personality aspects, perceived privacy, perceived usefulness, trust and perceived risk. The model needed to be assessed in order to determine the validity of each construct and their effect on intentions to use LBS.

Study 1 focused on whether or not the constructs suggested in the model were present in data gathered using a specifically designed LBS questionnaire (chapter 4). Factor analysis identified 10 factors; some related directly to the intended constructs, while others were made up of a combination of items from existing scales. The factors identified from the suggested model were *intentions to use LBS, neuroticism, perceived usefulness, trust (of the employer and LBS provider), perceived risk and conscientiousness*. The remaining factors consisted of a mixture of the questionnaire items, and were named as *disclosure to employer, employer responsibility and out of work tracking*. These results show that the Junglas & Spitzmüller model constructs were not uniformly identified in the data; some were present, while others were not accounted for. A regression was conducted using the identified factors, with intentions to use LBS as the predicted variable and neuroticism, perceived usefulness, trust (of the employer and LBS provider), perceived risk, conscientiousness, disclosure to employer, and employer responsibility as the predictor variables. The regression indicated that perceived usefulness, trust of the LBS provider and disclosure to employer predicted intentions to use LBS.

Study 2 aimed to test this new model by redistributing the questionnaire, based on the first study results and using the constructs identified as predictive of intentions to use LBS (chapter 5). Factor analysis clearly identified all five constructs in the data: *disclosure to employer, trust of employer, trust of LBS provider, perceived usefulness, and intentions to use LBS*. A regression and structural equation modelling confirmed these findings; the model was reduced to four factors which could predict intentions to use LBS (Figure 10.1).

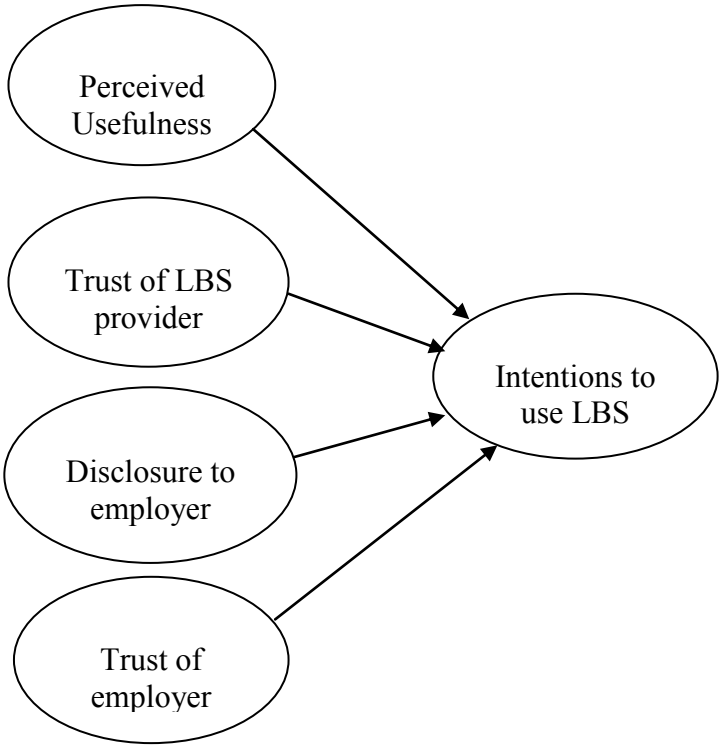


Figure 10.1 The new model to predict intentions to use LBS

This study revealed that when considering use of LBS, perceived usefulness and trust of the LBS provider are major contributing factors. Perceived usefulness features prominently in many models aiming to predict intention or behaviour, most notably in the Technology Acceptance Model (Davis, et al., 1989). Trust of an LBS provider,

however, has not explicitly been addressed in the literature. The findings in this thesis suggest that the less trustworthy the LBS provider, the less likely a person will intend to use LBS technology. Disclosure to employer was also found to predict intentions to use LBS. This factor relates to concerns about the collection, storage, and subsequent access to personal location information. People are not only concerned about the *active* process of tracking, but they have reservations about the manipulation of their information after its collection.

In order to explore other ways LBS may be used, questions were included which related to the use of LBS within social networking sites (SNS). This was an opportunity for exploration of LBS use beyond workplace constraints. The questions explored areas of trust, disclosure preferences and intentions. Factor analysis revealed three components in the data: disclosure to SNS, trust of SNS, and intentions to use LBS (via SNS). Regression analysis indicated that both disclosure to SNS and trust of SNS were predictive of intentions to use LBS (via SNS). These findings emphasise that people still consider trust issues and disclosure of location information important when using LBS socially. In particular, users question the trustworthiness of SNS. These findings seem to contradict the growing number of openly used online location-tracking applications becoming available.

In summary, these studies have provided support for a new and validated model which can predict intentions to use LBS, as well as developing a psychometric tool to assess LBS use in the workplace. As well as supporting previous research, which has suggested constructs such as perceived usefulness play a role in technology adoption, new factors emerged which were not considered in the LBS literature before.

10.3 What do we now know about LBS use in different contexts?

This section will summarise the findings from the third study (described in chapter 6) which focused on disclosure preferences. The answer to the second research question, focusing on LBS use in different contexts, will then be reported.

10.3.1 Disclosure and privacy preferences

The next research approach was a departure from model testing, and aimed to address the first research question, focusing on privacy and disclosure. **Study 3** explored how people would react to requests for location information, what types of location information would be disclosed using LBS, and who the information would be disclosed to. Participants were asked to list different types of location information, and consider who they might divulge that information to as if someone had requested it whilst they were using an LBS device. Participants were then required to group the location information statements into groups of similarity. Multidimensional scaling (MDS) was used to cluster the information.

Participants grouped location information into four categories: *family events, social events, formal social events and medical events*. There were distinct preferences for disclosure depending on the requester of information. Participants were less willing to disclose social information to people in a position of authority, and disclosure was often refused because it was deemed inappropriate. Overall, social information was disclosed more often, to parents, partners and work friends. The option to disclose to financial or anonymous people was least desirable. When people agreed to disclose their information, they disclosed to the most appropriate rather than preferred person

in that context. Participants considered whether a person would benefit from knowing their location, and decisions were often based on necessity.

The disclosure literature suggests that people are more likely to reveal sensitive information depending on the way it is revealed (Joinson, 2001). Researchers have also emphasised the importance of context (Iachello, et al., 2005), and the requester of information (Lederer, Mankoff, & Dey, 2003) when thinking about disclosure. Despite research focusing on the ways information might be disclosed to different categories of people (Olson, et al., 2005), few studies have allowed participants to choose their own categories of information disclosure. Similarly, there has been minimal research which looks at the impact of disclosure using LBS specifically. The study reported in this thesis has shown that people categorise location information differently, and despite previous research suggesting disclosure preferences are solely based on the requester of information, context and necessity also contribute significantly to disclosure decisions. In terms of LBS design, this work provides a rationale for ensuring users can personalise an LBS system, rather than assuming an 'all or nothing approach' to disclosure will suffice.

10.3.2 Use of LBS within different contexts

In order to understand LBS in context, three different user groups were involved in qualitative interviews: a lone worker, older adults, and a family with a behaviour disordered teenage son. These studies had the aim of uncovering how users felt about LBS technology, how it impacted on their lives, but importantly if the technology could work successfully with different populations.

Study 4 focused on LBS use in a work context (chapter 7). A lone worker based at Northumbria University, who had experience of using LBS during a work-based trial, was interviewed at length about her experience. Qualitative thematic analysis revealed the main motivation for LBS use was safety. This was boosted by the acknowledgement that existing in-house safety procedures were not always effective; however the participant did prefer human contact when going out alone. A lacking relationship with the LBS provider was a major concern for the participant, and an overall criticism of the trial.

The gathering of personal information before the trial started caused enough concern for other employees to refuse participation. The participant who did take part emphasised there was a lack of understanding about *why* personal information was being collected, or where it would be stored, which was a major reason for non-compliance of colleagues. Another concern was the amount of visibility LBS could encourage, and the participant was apprehensive about wearing a name badge (with an embedded tracking device), because this deviated from their normal routine. The participant was also concerned about the privacy protection of the people they visited during working hours.

Study 5 focused on the experiences of older adults who had used LBS, with thirteen participants interviewed in their own homes (chapter 8). A lack of familiarity with technology encouraged a fear of the unknown and an apprehension about using LBS. Participants also experienced problems using LBS because of the reliance on remembering to take the device out with them. When thinking about the wider implications of LBS use, participants were extremely concerned about the possibility of crime, and felt that their location information could be exploited. This hesitation

contrasted with feelings of the inevitability of LBS, and a sense of resignation about information already being shared.

However, participants did feel that LBS would benefit older, vulnerable people, although they did not consider themselves to be old or vulnerable. A number of participants felt that Alzheimer's patients could be effectively monitored with LBS. The older adults believed that trustworthy people with good intentions should look after their data, which affected who they believed should have access to information: friends and family. Despite these restrictions, in general participants were not overly concerned about who had access to their information; rather they wanted to know *why* people would want to access it in the first place. Aspects of safety notwithstanding, participants struggled to understand how, why and what they would use LBS for.

Study 6 involved an interview with a family who had a son with Aspergers Syndrome and ADHD (chapter 9). The family used LBS technology with the aim of managing their son's erratic behaviour associated with his disorders. One of the family's greatest challenges was his independent navigation. Their son frequently became disoriented and relied on his parents to find him. With the aid of LBS he began taking initiative, and he was able to plan routes using the LBS map on his mobile phone.

The most significant change during this family's trial of LBS was a sense of improved well-being. LBS technology provided the parents with reassurance about their son's location, which reduced anxiety and stress. The inability to be deceitful also improved parent-child communication, and a growing trust developed within the

family. The son became more independent, acknowledged curfews, and was able to manage his own activities which reduced family concern. In terms of privacy, the focus on the family unit meant that concerns were not about who could locate their son, but whether or not he was happy about being tracked. Although this trial highlighted the somewhat indirect effects of LBS technology, the changes in independence and freedom experienced by this family show that LBS should not be restricted to people who are *expected* to benefit, but should be considered applicable to a range of people.

In conjunction with what we know from the new model predicting intentions to use LBS (chapter 5), the qualitative interviews provide support for the importance of the identified factors. For example, older adults identified usefulness of the technology, although they didn't feel LBS technology was particularly useful to them at their particular stage in life. In contrast, the lone worker felt that LBS could enhance her existing work safety protocol, and was therefore more willing to use it if it had been permanently implemented at work. The perceived usefulness of the technology for the family was exceptionally high, and they agreed that as long as it remained to be useful to them, LBS would continue to be used.

The interviews also revealed that participants considered trust of the LBS provider important. The lone worker in particular not only desired a positive relationship with them, but needed a sense of trust to be able to use the technology effectively. The family setting, with a closer relationship already existing with the LBS provider, meant that concerns were minimal. The older adults suggested that in general information is too easily lost or abused, and citing recent government losses as an example, were less trusting of anyone in authority. The only instance in which trust

of an employer became an issue was when LBS were used with the lone worker. However, the participant did say that she felt more trusting of her employer than perhaps other colleagues, and did not feel that trust would hinder her use of the technology in the future.

There have been few, if any, case studies documenting actual LBS use with people. There have been even fewer good quality qualitative studies exploring user perceptions of LBS technology. Research with older adults tends to focus on assistive technologies used with vulnerable groups (Essén, 2008). Even research into LBS use with an older population focuses on disability (Müller, et al., 2010). Until now, research into LBS use in healthy older adults has been lacking, despite the obvious benefits of such technology. LBS research from the perspective of the lone-worker has also been limited. Studies have only assessed employee conformity, or measured their privacy concerns in response to monitoring systems in general (e.g. Zweig & Webster, 2002). Similarly, although there have been numerous studies which investigate the use of assistive technologies with families and children with disabilities (e.g. Carmien, et al., 2005; Dawe, 2006) no explicit review of LBS use in this setting had been conducted. All three of the case studies described in this thesis add a new dimension to the LBS literature, and an understanding of different contexts in which LBS may be used.

10.4 Implications and recommendations for industry

This research provides a wealth of information for the LBS industry. The qualitative findings from the case studies emphasise that in order for LBS to effectively appeal to real people, their concerns must be addressed. These participants perceived LBS in

different ways, which ultimately impacted on their decisions about use of the technology in the future. If we know that usefulness, trust, and disclosure are important to potential users, then companies should systematically consider these issues.

Considering the sensitive nature of location information, being able to trust an unknown entity to manage it is questionable. The majority of participants in the qualitative studies expressed that their knowledge of LBS providers was limited, but knowing what role the LBS provider would play was considered important. In order to alleviate concerns, service providers should make it clear to customers what kind of service they offer, and what the customer can expect in terms of communication with them. It may be the case that some LBS providers do not have an effective strategy for developing this relationship. The aim of this improved relationship would be to develop trust over time, and provide reassurance to the customer.

Other researchers have suggested that in order to improve the LBS provider image, linking them to a knowledgeable brand may help (Pura, 2005). Familiarity could be encouraged by perhaps emphasising relationships with an existing mobile phone service provider. This would obviously depend on the nature of that relationship, but the interviews suggested that people were more trusting of people they already had contact with.

In order to address disclosure concerns, it is recommended that the LBS provider explains their information storage procedures to customers, and in particular who would have access to that personal information. This information would need to be delivered in an appropriate format for the audience, but it is clear that people have a

desire for involvement in procedures and details which may currently be hidden from them.

It needs to be acknowledged that people may not necessarily seek out the kind of LBS described here, or understand how they work. In order for LBS to be used more successfully in wider society, it may be necessary to liaise with local councils, agencies, or support groups to understand who could benefit from it the most. The type of person who may benefit from LBS cannot be prescribed, and if industry wishes to utilise this technology with wider user groups, there needs to be some reconsiderations. At present LBS are predominantly advertised to work-based groups. In order to enable LBS to reach other populations, industry needs to think about the ways in which the technology is presented, and tailor this to different people.

In terms of LBS design, results suggest the need for some form of personalisation or modification to be available for people when using LBS devices. In particular, results from study 3 (chapter 6) showed that people do not always disclose the same kinds of information to the same people. Although the technical solutions are beyond the scope of this thesis, it is necessary to ensure design of LBS equipment has different accessibility levels. This research has also shown that the way the technology is embedded into a device can affect the way people perceive it, and desire to use it. For example, the lone worker participant suggested that the name badge format was not suited particularly well to her work, and a more discreet device such as an LBS-enabled mobile phone may be more suitable. This issue was also evident when interviewing older adults, as they sometimes forgot to put the LBS device on their arm. If the system was integral to another frequently used device, such as a watch or

mobile phone, people may feel more inconspicuous. The LBS device could also be designed to fit in with, or complement existing safety procedures.

In summary, a number of recommendations can be drawn from this thesis in order to benefit and enhance industry practise:

1. Meet potential LBS customers face to face, and wherever possible, assign the same company representative to that customer for future communications.
2. Clearly explain the role the LBS provider will play in terms of expected contact, technical assistance, contact via e-mail/telephone etc.
3. Aim to build up a positive working relationship with customers- trust of the provider has been shown to be important when predicting LBS use.
4. When providing LBS for use in a workplace environment, make explicit the role the employer will have. If management of the technology will be overseen by the LBS provider only, make this clear. If the employer will be involved in the monitoring of employees, explain in what capacity.
5. Make the procedures for data collection, storage and disposal of location information explicit.
6. Assess each customer individually, in terms of device requirements. Collaborate with customers regarding what type of LBS hardware would suit their needs best.
7. Wherever possible, enable some form of control over the LBS device for its users, possibly even reciprocal tracking of colleagues/management if feasible.

10.5 Implications and recommendations for workplace LBS initiatives

With LBS companies predominantly focusing on providing this technology to employees, the findings suggest there needs to be greater consideration of how employees feel about their employers to ensure successful adoption. As trust issues have been found to be important, any workplace LBS initiative requires thorough consultation with employees before implementation. A number of participants talked about choice being important, and felt that being given the opportunity to turn off the LBS system was desirable. Whilst in the workplace this may not always be optional, employers need to listen to staff and designate times for the use of the technology during working hours. Another finding from the lone-worker case study was that the participant felt an employer would not be the preferred manager for a new LBS system at work; the skills and experience of an LBS provider were deemed most suitable.

The new LBS model shows 'disclosure to employer' is an important predictor of intentions to use LBS. These disclosure questions related to information collection and availability of location data in particular. The emergence of this factor suggests that regardless of trust in your employer, how they collect, store and disseminate your location information will determine how you feel about LBS. Regardless of the ways in which responsibility is assigned, people need to understand who is responsible for what service, and who to ask if they have concerns.

Whilst recommendations for LBS use within the workplace have been suggested, it is important to recognise that the qualitative studies reported in this thesis emphasise LBS can also be used in alternative contexts. The concerns of families and older

adults regarding LBS adoption have shown to differ, however. The LBS industry needs to consider different privacy and security concerns for these populations.

10.6 Research contributions

This research aimed to add to the LBS literature with a dedicated exploration of LBS technology use. This work has filled an obvious gap in the literature by testing and revising a model to predict intentions to use LBS technology, and uncovering issues surrounding the adoption of LBS in different contexts.

Previous research has shown that people are concerned about *who* views their information (Ackerman, et al., 1999), and when revealing location information, the type of requester can determine whether to disclose or not (Lederer, Mankoff, & Dey, 2003). Privacy research has also suggested that people like flexibility when using technology, and narrowly defined groups may not suit everyone's disclosure preferences (Patil & Lai, 2005). Study 3 indicated that people *are* concerned about the requester of information, and it is their *relationship* with the requester of information that has a great impact on LBS decision making. Knowing who is likely to request information strongly influences disclosure preferences. Familiarity was emphasised, and participants from the case studies explicitly defined trusted people such as family and friends, or the police and medical professions, who would be allowed to access location data.

There has been an inherent assumption about privacy concerns in the literature regarding location tracking technology, with researchers emphasising the 'Big Brother' nature of LBS, and the unsavoury future of enforced monitoring. From these assumptions about privacy there has been an attempt to incorporate

mechanisms into the technology which could alleviate concern (e.g. Ghinita, 2008). However, this thesis has revealed that although users of LBS do consider privacy issues, concern often focuses on the level of trust in people involved within the LBS process, such as the LBS provider or an employer. It is important for research to be conducted in this area to eliminate preconceptions, as this work has uncovered that people consider different aspects of LBS as important.

A number of themes found in this research provide a more detailed understanding of LBS use. Previous work shows that people value feedback and the opportunity for reciprocal tracking, which may encourage LBS participation (Tsai, Kelley, Drielsma, et al., 2009). This practise was also to be particularly useful for the family who used LBS to locate their son. Reciprocal tracking enabled freedom for the family, as well as a development of trust. This case study was one of the most positive reviews of LBS technology, and showed that with a supportive network and appropriate training, LBS can significantly improve the lives of its users beyond recognition. The opposite was apparent in the study of the lone-worker. The distinct lack of training and poor communication with employer and LBS provider meant that people were apprehensive in adopting and using the technology, and struggled to utilise its full potential. The older adult experiences suggest that LBS *could* be used to enhance feelings of safety, providing trust issues were addressed. The work presented in this thesis provides evidence for use of LBS with different populations, and suggests that with careful consideration of relationships involved when implementing this kind of technology, privacy concerns can be minimised.

The work documented in this thesis has also significantly contributed to our theoretical understanding of LBS. The model proposed by Junglas & Spitzmüller

was tested, refined, and improved. A new model which predicts intentions to use LBS has now been identified. The new model shows that a smaller number of issues are considered when thinking about LBS use: predominantly perceived usefulness and trust. These findings were also reflected in the case study interviews, and together this research contributes to a new way of thinking about LBS adoption.

10.7 Methodological considerations and directions for future research

In this section, the methodologies used in this research will be summarised and considered, before reflecting on work that could be improved or developed further.

The work presented in this thesis used a variety of diverse methodologies to investigate the phenomenon of LBS (a summary of the studies and methodologies can be seen in Table 10.1 and 10.2). This triangulation approach was used in order to ensure the most detailed and thorough understanding of LBS could be achieved. The studies described in chapters 4 and 5 utilised questionnaires to assess a model to predict LBS use, with factor analysis, regression, and structural equation modelling used to analyse data. The disclosure study described in chapter 6 required participants to take part in concept elicitation and card sorting tasks; data was then analysed with multidimensional scaling. The case studies described in chapters 7, 8 and 9 used semi-structured, in-depth qualitative interviews to explore user perceptions of LBS. These methods were purposefully chosen to produce diverse types of data, which could positively contribute to the overall understanding of LBS. This varied methodological approach has not been seen in the LBS literature to date, and suggests that both qualitative and quantitative studies can offer complimentary and valuable insights into the adoption and use of LBS.

Another strength of this research is the varied populations that have been included. For example, the questionnaire studies targeted employed people. The majority of research described in the LBS literature relies on student populations, or groups who are already familiar with the technology. In particular, the family case study involving a mother and father with a child who had ADHD was a unique example of the way LBS can be used. This interview suggested that the technology significantly improved family life, however these types of potential LBS users have rarely been considered in previous literature.

Despite the inclusion of various methodologies and user groups, however, the work described in this thesis does not provide an exhaustive assessment of LBS. As summarised in chapter 7, a number of LBS systems are predominantly being targeted at businesses. This technology is often suggested as a solution to an employer's duty of care towards their employees (TrackaPhone, 2011), and the scope for LBS use in the workplace will undoubtedly grow. Firstly, whilst the findings from the lone worker case study provide valuable information regarding LBS use in the situation, more research is needed in order to fully understand the application of LBS in the workplace.

Secondly, the use of LBS within online social networking sites (SNS) is becoming widely available with the development of mobile applications such as Facebook Places and Foursquare. This way of locating friends and family has only really developed in the last year with the use of smart phones. Research in this field needs to acknowledge that LBS are becoming effortlessly and routinely used by more and more people. A section of the questionnaire described in chapter 5 acknowledged this development by asking exploratory questions about LBS use within social

networking sites. More research undoubtedly needs to be carried out to understand what predicts location disclosure using SNS, and the user perceptions of them.

Finally, this research has produced a useable measurement tool which can predict intentions to use LBS in the workplace. In order to assess the model further, it would be of interest to explore this questionnaire with different populations, as it is clear that applications for LBS are not limited to the workplace. A questionnaire to predict intentions to use LBS via social networking sites, or a family setting, or with older adults, for example, would be valuable for industry as well as other researchers.

.

Table 10.1 A summary of studies 1-3

Study	**Study 1 & 2**		**Study 3**
Study type	Questionnaire Phase 1	Questionnaire Phase 2	Disclosure grids
Participant group	106 UK employed	471 US employed 508 UK employed	Concept elicitation: n = 60 Card sorting: n = 37
Analysis	Factor Analysis Regression	Factor Analysis Regression Structural Equation Modelling	Multidimensional scaling
Main findings	• 10 factors identified, 7 from Junglas and Spitzmüller model • Intention to use LBS predicted by perceived usefulness, trust of LBS provider and disclosure to employer	• 5 factors identified from revision of first questionnaire • Intention to use LBS predicted by perceived usefulness, trust of LBS provider, disclosure to employer and trust of employer • SEM model a good fit	• Information grouped into family, social, formal social and medical clusters • Social information more readily disclosed than other types • Disclosure depends on context and type of relationship

Table 10.2 A summary of studies 4-6

Study	**Study 4**	**Study 5**	**Study 6**
Study type	Interviews with LBS users		
Participant group	1 female, aged 27, lone worker	13 older adults, identified from university database	2 parents from a family unit with a behaviour-disordered teenage son
Analysis	Exploratory qualitative analysis of semi-structured interviews		
Main findings	**Common themes**	**Unique themes**	
	• Usability and technical issues (difficulty for parents and older adults) • Trust in stakeholders/LBS providers • Usefulness of the technology • Data collection (and storage) • Privacy (related to who sees information) • Physical safety (unexpected accidents/attacks) • Vulnerability (older adults, children)	• Visibility (and the protection of others) • Apathy, feelings of unimportance • Autonomy, the option to choose LBS • Crime (exploitation of data) • Reassurance (peace of mind) • Personal development and freedom (technology offering new opportunities) • Reciprocal tracking (within a family unit)	

10.7.1 Final conclusions

This research has identified a number of key factors that may influence LBS use. The new LBS model provides a valuable framework for thinking about LBS adoption, and has shown that perceived usefulness of the technology and trust of the LBS provider are major factors considered by potential users. Case studies have demonstrated that LBS can be used successfully in different contexts; a trusting relationship with the LBS provider and greater understanding of information privacy practises may encourage LBS use with older adults. Appropriate technical training and increased communication with the LBS provider may improve the perception of LBS for lone workers. LBS use in a family setting suggests that benefits of this technology far outweigh the costs of privacy concerns.

In summary, the research described in this thesis has enhanced our knowledge by proposing a new model able to predict LBS use, as well as highlighting different contexts to which the technology may be applicable. This work has positively contributed to the literature, and suggests clear directions for future research.

APPENDICES

11.1 Pilot questionnaire

Location Based Services Questionnaire

We would like to find out your views on lone-worker protection schemes and Location Based Services (LBS). Location-based services collect information about your geographical position using your mobile phone or PDA. Using location-tracking devices, your mobile provider is able to identify your geographical position at any point, anywhere. This information can be requested by an external entity. If you are working away from your office, for example, your employer could locate where you were. Location tracking devices are often put in place to help employees who work alone, outside, or in high risk areas.

1. Gender:

Female ☐ Male ☐

2. Age:

18-25	26-35	36-45	46-55	56-65	66-75	76-85	85+
☐	☐	☐	☐	☐	☐	☐	☐

3. Do you currently have a LBS system at work? Yes ☐ No ☐

4. If yes, how often do you use the LBS system?

Not at all	Less than once a week	About once a week	2 or 3 times a week	4 to 6 times a week	About once a day	More than once a day
☐	☐	☐	☐	☐	☐	☐

If you already use LBS in your workplace, please answer the questions bearing in mind your experiences and attitudes towards LBS systems.

If you do not use LBS, please answer hypothetically *as if* your employer had introduced this technology. Your employer will not have access to any of your answers.

Be honest, and remember there are no right or wrong answers.

Please answer the following questions using a rating scale from 1 (strongly agree) to 7 (strongly disagree):

Strongly Agree	Agree	Agree somewhat	Neither agree nor disagree	Disagree somewhat	Disagree	Strongly Disagree
1	2	3	4	5	6	7

5.	I intend to use a device which would allow my employer to locate me during working hours	1	2	3	4	5	6	7
6.	I intend to use a device which would allow my employer to locate me travelling to and from work	1	2	3	4	5	6	7
7.	I intend to use a device which would allow my employer to locate me outside working hours	1	2	3	4	5	6	7
8.	If my company implements a LBS system, I will accept this and try not to avoid it	1	2	3	4	5	6	7
9.	If my company implements a LBS system, I will encourage my colleagues to accept this policy and try not to avoid it	1	2	3	4	5	6	7
10.	I am very likely to disclose my location information in order to use LBS	1	2	3	4	5	6	7
11.	Given the chance, I predict I would use LBS in the future	1	2	3	4	5	6	7

I would find location tracking acceptable if...

12.	I was out of the office speaking to customers	1	2	3	4	5	6	7
13.	I was travelling to and from work	1	2	3	4	5	6	7
14.	I was on the road during working hours	1	2	3	4	5	6	7
15.	I was working alone	1	2	3	4	5	6	7
16.	I was somewhere a great distance from my workplace	1	2	3	4	5	6	7
17.	I was working in an unknown area	1	2	3	4	5	6	7
18.	My employer could locate me at any time	1	2	3	4	5	6	7
19.	A colleague could locate me at any time	1	2	3	4	5	6	7
20.	A friend could locate me at any time	1	2	3	4	5	6	7
21.	A family member could locate me at any time	1	2	3	4	5	6	7
22.	I could control when to turn the LBS system on and off	1	2	3	4	5	6	7
23.	My employer could control when to turn the LBS system on and off	1	2	3	4	5	6	7
24.	I could control who has access to my location information	1	2	3	4	5	6	7

Strongly Agree	Agree	Agree somewhat	Neither agree nor disagree	Disagree somewhat	Disagree	Strongly Disagree
1	2	3	4	5	6	7

The following statements refer to you. Research has shown the type of person you are will affect how receptive you are to technology uptake.

25. I see myself as dependable, self-disciplined	1	2	3	4	5	6	7
26. I see myself as disorganised, careless	1	2	3	4	5	6	7
27. I see myself as prepared	1	2	3	4	5	6	7
28. I see myself as hard working	1	2	3	4	5	6	7
29. I am persistent in order to get things done	1	2	3	4	5	6	7
30. I aim to improve my job performance wherever possible	1	2	3	4	5	6	7
31. I see myself as open to new experiences, complex	1	2	3	4	5	6	7
32. I see myself as conventional, uncreative	1	2	3	4	5	6	7
33. I embrace new ideas	1	2	3	4	5	6	7
34. I seek out new experiences	1	2	3	4	5	6	7
35. I welcome change in the workplace	1	2	3	4	5	6	7
36. I see myself as sympathetic, warm	1	2	3	4	5	6	7
37. I see myself as critical, quarrelsome	1	2	3	4	5	6	7
38. I see myself as calm, emotionally stable	1	2	3	4	5	6	7
39. I see myself as anxious, easily upset	1	2	3	4	5	6	7
40. I see myself as extraverted, enthusiastic	1	2	3	4	5	6	7
41. I see myself as reserved, quiet	1	2	3	4	5	6	7

---

42. It bothers me if my employer stores my location information	1	2	3	4	5	6	7
43. I'm concerned that my employer will collect too much location information about me	1	2	3	4	5	6	7
44. I'm not comfortable with the idea that my employer is able to track me at any time	1	2	3	4	5	6	7
45. I would rather not provide my location information to my employer	1	2	3	4	5	6	7
46. The amount of location information stored by my employer should be strictly limited	1	2	3	4	5	6	7
47. I feel I have very little power to keep my employer from storing location information about me	1	2	3	4	5	6	7

Strongly Agree	Agree	Agree somewhat	Neither agree nor disagree	Disagree somewhat	Disagree	Strongly Disagree
1	2	3	4	5	6	7

48. I feel I have very little power to keep my employer from storing location information about me	1	2	3	4	5	6	7
49. All location information in computer databases should be double-checked for accuracy- no matter how much this costs	1	2	3	4	5	6	7
50. My employer should take steps to ensure that the location information in their databases is accurate	1	2	3	4	5	6	7
51. My employer should have thorough procedures to correct errors in location information	1	2	3	4	5	6	7
52. My employer should not disclose location information to unauthorised parties	1	2	3	4	5	6	7
53. My employer should never share my location information without my consent	1	2	3	4	5	6	7
54. My employer should never sell location information of its employees to other companies	1	2	3	4	5	6	7
55. My location data could be used fraudulently	1	2	3	4	5	6	7
56. My employer should devote a lot of time and effort to preventing unauthorised access to location information	1	2	3	4	5	6	7
57. Databases that contain my location information should be protected from unauthorised access- no matter how much it costs	1	2	3	4	5	6	7
58. My employer should take steps to ensure that unauthorised people cannot access personal location-based services information	1	2	3	4	5	6	7
59. I am worried my location information could fall into the wrong hands	1	2	3	4	5	6	7
60. I feel confident that my privacy will not be compromised by LBS	1	2	3	4	5	6	7
61. Once I have given location information to my employer, I have lost control over the future release of that information	1	2	3	4	5	6	7
62. Using LBS in my job would enable me to accomplish tasks more quickly	1	2	3	4	5	6	7

Strongly Agree	Agree	Agree somewhat	Neither agree nor disagree	Disagree somewhat	Disagree	Strongly Disagree
1	2	3	4	5	6	7

63. Using LBS in my job would increase my productivity	1	2	3	4	5	6	7
64. I would find LBS useful in my job	1	2	3	4	5	6	7
65. Using LBS would improve my job performance	1	2	3	4	5	6	7
66. Using LBS would enhance my effectiveness at on the job	1	2	3	4	5	6	7
67. I would find LBS functional	1	2	3	4	5	6	7
68. LBS would be a convenient way for others to locate me	1	2	3	4	5	6	7
69. LBS would make me feel safer	1	2	3	4	5	6	7

The following questions relate to your attitudes about your LBS provider (if unknown, this should be relate to LBS providers in general), and your employer.

I feel that [...] is trustworthy							
70. The LBS provider	1	2	3	4	5	6	7
71. My employer	1	2	3	4	5	6	7
I feel that [...] is dependable							
72. The LBS provider	1	2	3	4	5	6	7
73. My employer	1	2	3	4	5	6	7
I feel that [...] is credible							
74. The LBS provider	1	2	3	4	5	6	7
75. My employer	1	2	3	4	5	6	7
I feel that [...] is a knowledgeable source regarding LBS							
76. The LBS provider	1	2	3	4	5	6	7
77. My employer	1	2	3	4	5	6	7
I feel that [...] keeps promises and commitments							
78. The LBS provider	1	2	3	4	5	6	7
79. My employer	1	2	3	4	5	6	7
I feel that [...] is reliable							
80. The LBS provider	1	2	3	4	5	6	7
81. My employer	1	2	3	4	5	6	7

Strongly Agree	Agree	Agree somewhat	Neither agree nor disagree	Disagree somewhat	Disagree	Strongly Disagree
1	2	3	4	5	6	7

I feel that [...] has a Duty of Care to know where I am

82. The LBS provider 1 2 3 4 5 6 7
83. My employer 1 2 3 4 5 6 7

I feel that [...] has my best interests in mind

84. The LBS provider 1 2 3 4 5 6 7
85. My employer 1 2 3 4 5 6 7

86. There would be too much uncertainty associated with divulging my location information 1 2 3 4 5 6 7

87. Providing my location information would involve many unexpected problems 1 2 3 4 5 6 7

88. It would be risky to disclose my location information 1 2 3 4 5 6 7

89. There would be high potential for loss with disclosing my location information 1 2 3 4 5 6 7

It has been suggested that feeling in control may affect your attitudes towards technology. Below are statements that people have made about their attitudes to life. Try to decide how far you agree or disagree with each statement:

90. Sometimes I feel that I don't have enough control over the direction my life is taking 1 2 3 4 5 6 7

91. By taking an active part in political and social affairs people can control world events 1 2 3 4 5 6 7

92. It is impossible for me to believe that chance or luck plays an important role in my life 1 2 3 4 5 6 7

93. Many times I feel that I have little influence over the things that happen to me 1 2 3 4 5 6 7

94. Getting people to do the right thing depends upon ability; luck has little or nothing to do with it 1 2 3 4 5 6 7

95. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries 1 2 3 4 5 6 7

Strongly Agree	Agree	Agree somewhat	Neither agree nor disagree	Disagree somewhat	Disagree	Strongly Disagree
1	2	3	4	5	6	7

96. Capable people who fail to become leaders have not taken advantage of their opportunities	1	2	3	4	5	6	7
97. This world is run by a few people in power, and there is not much the little guy can do about it	1	2	3	4	5	6	7
98. What happens to me is my own doing	1	2	3	4	5	6	7
99. Most people don't realise the extent to which their lives are controlled by accidental happenings	1	2	3	4	5	6	7
100. Peoples misfortunes result from the mistakes they make	1	2	3	4	5	6	7
101. There is really no such thing as 'luck'	1	2	3	4	5	6	7
102. The average citizen can have an influence on government decisions	1	2	3	4	5	6	7
103. In the long run people get the respect they deserve in the world	1	2	3	4	5	6	7
104. In my case getting what I want has little or nothing to do with luck	1	2	3	4	5	6	7
105. With enough effort we can wipe out political corruption	1	2	3	4	5	6	7
106. Who gets to be the boss often depends on who was lucky enough to be in the right place first	1	2	3	4	5	6	7
107. Many of the unhappy things in people's lives are partly due to bad luck	1	2	3	4	5	6	7
108. It is difficult for people to have much control over the things politicians do in office	1	2	3	4	5	6	7
109. People are lonely because they don't try to be friendly	1	2	3	4	5	6	7

The following questions relate to personality types. Please answer Yes or No by circling the appropriate box

110. Does your mood often go up and down?	Yes | No
111. Do you take much notice of what people think?	Yes | No
112. Are you a talkative person?	Yes | No
113. If you say you will do something, do you always keep your promise no matter how inconvenient it may be?	Yes | No
114. Do you even feel 'just miserable' for no reason?	Yes | No

115. Would being in debt worry you? Yes |No
116. Are you rather lively? Yes |No
117. Were you ever greedy by helping yourself to more than your fair share of anything? Yes |No
118. Are you an irritable person? Yes |No
119. Would you take drugs that may have strange or dangerous effects? Yes |No
120. Do you enjoy meeting new people? Yes |No
121. Have you ever blamed someone for doing something you knew was really your fault? Yes |No
122. Are your feelings easily hurt? Yes |No
123. Do you prefer to go your own way rather than act by the rules? Yes |No
124. Can you usually let yourself go and enjoy yourself at a lively party? Yes |No
125. Are *all* your habits good and desirable ones? Yes |No
126. Do you often feel 'fed-up'? Yes |No
127. Do good matters and cleanliness matter much to you? Yes |No
128. Do you usually take the initiative in making new friends? Yes |No
129. Have you ever taken anything (even a pin or a button) that belonged to someone else? Yes |No
130. Would you call yourself a nervous person? Yes |No
131. Do you think marriage is old-fashioned and should be done away with? Yes |No
132. Can you easily get some life into a rather dull party? Yes |No
133. Have you ever broken or lost something that belonged to someone else? Yes |No
134. Are you a worrier? Yes |No
135. Do you enjoy cooperating with others? Yes |No
136. Do you tend to keep in the background on social occasions? Yes |No
137. Does it worry you if you know there are mistakes in your work? Yes |No
138. Have you ever said anything bad or nasty about anyone? Yes |No
139. Would you call yourself tense or 'highly-strung'? Yes |No
140. Do you think people spend too much time safeguarding their future with savings and insurance? Yes |No
141. Do you like mixing with people? Yes |No
142. As a child were you ever cheeky to your parents? Yes |No
143. Do you worry too long after an embarrassing experience? Yes |No
144. Do you try not to be rude to people? Yes |No
145. Do you like plenty of bustle and excitement around you? Yes |No
146. Have you ever cheated at a game? Yes |No
147. Do you suffer from 'nerves'? Yes |No
148. Would you like other people to be afraid of you? Yes |No
149. Have you ever taken advantage of someone? Yes |No
150. Are you mostly quiet when you are with other people? Yes |No

151. Do you often feel lonely? Yes |No

152. Is it often better to follow society's rules than go your own way? Yes |No

153. Do other people think of you as being very lively? Yes |No

154. Do you always practise what you preach? Yes |No

155. Are you often troubled about feelings of guilt? Yes |No

156. Do you sometimes put off until tomorrow what you ought to do today? Yes |No

157. Can you get a party going? Yes |No

Thank you for taking part in this questionnaire.

Any feedback you have about this questionnaire would be valuable...

11.2 Questionnaire 1 cover letter

Department of Psychology
Northumberland Building
Newcastle upon Tyne
NE1 8ST
Tel: 0191 227 3471
Fax : 0191 227 3190

Dear Sir/Madam

I am a PhD research student in the School of Psychology & Sports Sciences at Northumbria University, Newcastle. I have obtained your postal details from data company 'Info UK', and will ensure your details are not passed on to any other parties.

I am investigating employee adoption of **Location-Based Services**. Location-Based Services can collect information about your geographical position using a mobile phone. This is done by using your location information held by the mobile phone networks (e.g. O^2, Vodafone, Orange). I hope to collect information about attitudes towards location-based services with a survey.

I have full ethical approval from the School of Psychology & Sports Sciences Ethics Board. No personal information will be collected.

It should not take more than 10 minutes to fill out the survey, and you will be entered into a prize draw once the responses are collected. I would be very grateful if you could complete the enclosed survey and return it in the pre-paid envelope provided.

If you have any questions or would like to discuss the research further please contact me by e-mail.

Yours sincerely

Lisa Thomas

PaCT Lab
Room 153 Department of Psychology
Northumbria University
Northumberland Building
Newcastle upon Tyne
NE1 8ST
+44 (0) 191 227 3716
lisa.thomas@northumbria.ac.uk

11.3 Questionnaire 1

Investigating The Use of Location Based Services

Thank you for taking the time to fill in this survey.

We are conducting this survey because we would like to find out your views on **Location Based Services (LBS)** in the workplace. Location Based Services can collect information about your geographical position using a mobile phone. This is done by using your Cell ID. Cell ID is the location information held by the mobile phone networks (O^2, Vodafone, Orange etc). Collecting this information about your location is becoming more common.

We think this area of research is important because:

- **Current users of LBS have reported clear advantages and disadvantages of such technologies.**
- **If you were working away from your office, for example, your employer could locate where you were.**
- **Location tracking devices are often put in place to help employees who work alone, outside, or in high risk areas.**

Whether you use this technology at work or not, we wish to find out your views about it. There are no right or wrong answers.

Your opinions are very important to this research. As a thank-you for completing this questionnaire, we are holding a prize draw. If you would like to be entered into the prize draw please write your postal address or e-mail below. The draw will be held 2 weeks after the closing date.

1st prize- £30 High Street Voucher

2nd prize- £10 High Street Voucher

3rd prize- £5 High Street Voucher

Address:

E-mail:

PLEASE RETURN BY 31ST MAY USING THE PRE-PAID ENVELOPE

Please fill in the consent form below before you proceed with the survey. This sheet will be detached from the survey and stored separately to your answers. The information you provide will be kept strictly private and confidential.

	please tick where applicable
I have read and understood the above information sheet.	☐
I have had an opportunity to ask questions (please e-mail the principal investigator lisa.thomas@northumbria.ac.uk)	☐
I understand I am free to withdraw from the study at any time, without having to give a reason for withdrawing, and without prejudice.	☐
I agree to take part in this study	☐
Optional: I would like to receive feedback on the overall results of the study at the email address given below. I understand that I will not receive individual feedback on my own performance. Email address.....	☐

Signature of participant..... Date.....

(NAME IN BLOCK LETTERS).....

Please think of a username (not your personal name) and write this on the top of the first survey page overleaf.

If you then wish to withdraw your data from the study, contact the investigator stating your chosen username.

Username: _____

Section A — Background information

We would like to ask some questions about you
(Remember that all of the information provided will be kept private and confidential).

Q.1 Could you please identify your age group: (please tick (✓) one box only)

16-19	☐ 1	45-59	☐ 4
20-24	☐ 2	59 and above	☐ 5
24-44	☐ 3		

Q.2 Are you (please tick (✓) one box only)

Male?	☐ 1	Female?	☐ 2

Q.3 Are you (please tick (✓) one box only)

White – British/Irish?	☐ 1	Black – other?	☐ 6
White – Other?	☐ 2	Indian?	☐ 7
Black – African/Caribbean?	☐ 3	Pakistani?	☐ 8
Black – British?	☐ 4	Bangladeshi?	☐ 9
Asian – British?	☐ 5	Chinese?	☐ 10
		Other? *(please state)*.....	☐ 13

Q.4 Are you (please tick (✓) one box only)

Working in full-time paid employment?	☐ 1	Self-employed?	☐ 3
Working in part-time paid employment?	☐ 2	Voluntary employment?	☐ 4
		Other? *(please explain in the box below)*	☐ 13

Q.5 Which employment sector do you work in? (please tick (✓) one box only)

Accountancy / Banking / Business Services	☐ 1	Advertising / Marketing / PR	☐ 7
Charity Work	☐ 2	Construction / Engineering /Agriculture	☐ 8
Education	☐ 3	Government / Public Sector	☐ 9
Health / Social Care	☐ 4	HR / IT / Legal Services	☐ 10
Manufacturing	☐ 5	Media / Publishing	☐ 11
Tourism / Hospitality / Retail	☐ 6	Transport / Logistics	☐ 12
		Other *(please state)*.....	☐ 13

Q.6 Do you have an LBS system in your workplace? **(please tick (✓) one box only)**

Yes	☐ 1	No (go to Q.7)	☐ 2

If yes, how often do you use the LBS system?

Not at all	☐ 1	4-6 times per week	☐ 5
Less than once per week	☐ 2	About once a day	☐ 6
About once per week	☐ 3	More than once a day	☐ 7
2-3 times per week	☐ 4		

Section B

Personality types

We would like to ask some questions about you (*Remember that all of the information provided will be kept private and confidential).*

Research has shown the type of person you are will affect how receptive you are to technology uptake. People with different personality types may have different attitudes towards LBS use.

Strongly agree	Agree	Agree somewhat	Neither agree/ disagree	Disagree somewhat	Disagree	Strongly disagree
1	2	3	4	5	6	7

Q.7 Could you rate the extent to which the below statements apply to you using the rating scale above: **(please tick (✓) one box on each line)**

	1	2	3	4	5	6	7
1. I see myself as dependable, self-disciplined	☐	☐	☐	☐	☐	☐	☐
2. I often feel blue	☐	☐	☐	☐	☐	☐	☐
3. I see myself as disorganised, careless	☐	☐	☐	☐	☐	☐	☐
4. I am very pleased with myself	☐	☐	☐	☐	☐	☐	☐
5. I dislike myself	☐	☐	☐	☐	☐	☐	☐
6. I am not easily bothered by things	☐	☐	☐	☐	☐	☐	☐
7. I feel comfortable with myself	☐	☐	☐	☐	☐	☐	☐
8. I have frequent mood swings	☐	☐	☐	☐	☐	☐	☐
9. I see myself as open to new experiences, complex	☐	☐	☐	☐	☐	☐	☐
10. I see myself as conventional, uncreative	☐	☐	☐	☐	☐	☐	☐
11. I rarely get irritated	☐	☐	☐	☐	☐	☐	☐
12. I panic easily	☐	☐	☐	☐	☐	☐	☐

13. I see myself as sympathetic, warm	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
14. I see myself as critical, quarrelsome	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
15. I see myself as calm, emotionally stable	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
16. I seldom feel blue	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
17. I see myself as anxious, easily upset	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
18. I am often down in the dumps	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
19. I see myself as extraverted, enthusiastic	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
20. I see myself as reserved, quiet	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

It has also been suggested that your general attitudes may affect your feelings towards technology. Below are statements that people have made about their attitudes to life.

Strongly agree	Agree	Agree somewhat	Neither agree/ disagree	Disagree somewhat	Disagree	Strongly disagree
1	2	3	4	5	6	7

Q.8 Could you rate the extent to which these statements apply to you using the rating scale above: (please tick (✓) one box on each line)

21. Sometimes I feel that I don't have enough control over the direction my life is taking	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
22. By taking an active part in political and social affairs people can control world events	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
23. It is impossible for me to believe that chance or luck plays an important role in my life	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
24. Many times I feel that I have little influence over the things that happen to me	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
25. Getting people to do the right thing depends upon ability; luck has little or nothing to do with it	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
26. Unfortunately, an individual's worth often passes unrecognised no matter how hard they try	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
27. Capable people who fail to become leaders have not taken advantage of their opportunities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
28. This world is run by a few people in power, and there is not much the little guy can do about it	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
29. What happens to me is my own doing	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
30. Most people don't realise the extent to which their lives are controlled by accidental happenings	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
31. Peoples misfortunes result from the mistakes they make	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
32. There is really no such thing as 'luck'	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

33. The average citizen can have an influence on government decisions	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
34. In the long run people get the respect they deserve in the world	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
35. In my case getting what I want has little or nothing to do with luck	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
36. With enough effort we can wipe out political corruption	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
37. Who gets to be the boss often depends on who was lucky enough to be in the right place first	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
38. Many of the unhappy things in people's lives are partly due to bad luck	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
39. It is difficult for people to have much control over the things politicians do in office	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
40. People are lonely because they don't try to be friendly	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

Section C

Personal data storage

We now wish to find out your attitudes about your employer, data collection, and the people that provide LBS services *(Remember that all of the information provided will be kept private and confidential).*

Strongly agree	Agree	Agree somewhat	Neither agree/ disagree	Disagree somewhat	Disagree	Strongly disagree
1	2	3	4	5	6	7

Q.10 Could you rate the extent to which these statements apply to you using the rating scale above: **(please tick (✓) one box on each line)**

41. It bothers me if my employer stores my location information	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
42. It bothers me when my location information is available to my employer	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
43. My employer is trustworthy	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
44. I'm concerned that my employer will collect too much location information about me	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
45. I'm not comfortable with the idea that my employer is able to track me at any time	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
46. I would rather not provide my location information to my employer	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
47. All location information in computer databases should be double-checked for accuracy - no matter how much this costs	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
48. The LBS provider would be trustworthy	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
49. My employer should take steps to ensure that the location information in their databases is accurate	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

Strongly agree	Agree	Agree somewhat	Neither agree/ disagree	Disagree somewhat	Disagree	Strongly disagree
1	2	3	4	5	6	7

50. My employer should have thorough procedures to correct errors in location information	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
51. My employer should not disclose location information to unauthorised parties	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
52. My employer should never share location information without my consent	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
53. My employer should not use my location information for any purpose unless it has been authorised by me	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
54. My employer should never sell location information of its employees to other companies	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
55. My employer is known as one that keeps promises and commitments	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
56. My employer should devote a lot of time and effort to preventing unauthorised access to location information	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
57. Databases that contain my location information should be protected from unauthorised access - no matter how much it costs	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
58. The LBS provider would keep promises and commitments	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
59. My employer should take steps to ensure that unauthorised people cannot access personal location-based services information	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
60. Using LBS would improve my performance at work	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
61. Using LBS at work would increase my productivity	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
62. I trust that my employer has my best interests in mind	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
63. Using LBS would enhance my effectiveness at work	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
64. I would find LBS useful at work	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
65. There is a considerable risk involved in participating in LBS use	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
66. I trust that the LBS provider would have my best interests in mind	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
67. There is high potential for loss involved in participating in LBS use	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
68. My decision to participate in LBS use is risky	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

Section D *The future use of LBS at work*

We would now like to ask you about the acceptability of using Location Based Services in the workplace, and more specifically, when you think a tracking system would be relevant in the workplace.

Strongly agree	Agree	Agree somewhat	Neither agree/ disagree	Disagree somewhat	Disagree	Strongly disagree
1	2	3	4	5	6	7

Q.11 Assuming you had access to LBS, please answer the following questions using the rating scale above: (please tick (✔) one box on each line)

	1	2	3	4	5	6	7
69. I would use it to be located travelling to and from work	☐	☐	☐	☐	☐	☐	☐
70. LBS would help if I was working alone	☐	☐	☐	☐	☐	☐	☐
71. I would use it to be located during working hours	☐	☐	☐	☐	☐	☐	☐
72. LBS would help if I was somewhere a great distance from my workplace	☐	☐	☐	☐	☐	☐	☐
73. I would use it to be located outside working hours	☐	☐	☐	☐	☐	☐	☐
74. LBS would help if I was working in an unknown area	☐	☐	☐	☐	☐	☐	☐
75. I would use LBS to allow my employer to locate me travelling to and from work	☐	☐	☐	☐	☐	☐	☐
76. I would use LBS to allow my employer to locate me during working hours	☐	☐	☐	☐	☐	☐	☐
77. LBS would help if I was working in a dangerous area	☐	☐	☐	☐	☐	☐	☐
78. I would use LBS to allow my employer to locate me outside working hours	☐	☐	☐	☐	☐	☐	☐

Q.12 Do you wish to tell us about anything else you think is important about LBS or have any comments on this survey?

Thank you for completing this survey

Reverse scoring was applied for questions 3, 4, 5, 7, 10, 11, 16, 21, 24, 26, 28, 20, 37, 38 and 39 (in the main body of the questionnaire).

11.4 Questionnaire 1: Factor Analysis output (21 factors)

	Component																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Q1_TIPI														.727							
Q2_NEUR			.766																		
Q5_NEUR			.545																		
Q8_NEUR			.673																		
Q9_TIPI																	.687				
Q12_NEUR			.657																		
Q18_NEUR			.683																		
Q22_LOC							.797														
Q23_LOC										.766											
Q25_LOC										.531											
Q27_LOC									.537										-.357		
Q29_LOC				.489																	
Q31_LOC									.783												
Q32_LOC										.782											
Q33_LOC							.869														
Q34_LOC				.393												.437					
Q35_LOC									.449	.410											
Q36_LOC							.437													.394	
Q40_LOC									.775												
Q41_PRIV		.866																			
Q42_PRIV		.870																			
Q43_TRU				.776																	
Q44_PRIV		.768																			
Q45_PRIV		.802																			
Q46_PRIV		.846																			
Q47_PRIV												.496									
Q48_TRU													.861								
Q49_PRIV												.803									

Q50_PRIV											.733									
Q51_PRIV						.756														
Q52_PRIV						.817														
Q53_PRIV						.759														
Q54_PRIV						.660														
Q55_TRU				.792																
Q56_PRIV						.626														
Q57_PRIV														.711						
Q58_TRU												.627								
Q59_PRIV														.678						
Q60_USE					.849															
Q61_USE					.854															
Q62_TRU				.751																
Q63_USE					.892															
Q64_USE					.742															
Q65_RISK		.421								.579										
Q66_TRU												.353							.587	
Q67_RISK										.736										
Q68_RISK		.447								.629										
Q69_INT	.412							.608												
Q70_TAS K	.818																			
Q71_INT	.801																			
Q72_TAS K	.862																			
Q73_INT								.817												
Q74_TAS K	.871																			
Q75_INT								.671												
Q76_INT	.756																			
Q77_TAS K	.820																			
Q78_INT								.781												
Q3TIPI_R													.781							
Q4_NEUR _R																	.823			

Q6_NEUR_R			.488														-.369				
Q7_NEUR_R			.506													.484					
Q10_TIPI_R																-.721					
Q11_NEUR_R			.375														-.549				
Q16_NEUR_R			.813																		
Q21_LOC_R			-.477	.561																	
Q24_LOC_R				.544																	
Q26_LOC_R																					
Q28_LOC_R							.637														
Q30_LOC_R																			.695		
Q37_LOC_R				.542																	
Q38_LOC_R																					.654
Q39_LOC_R							.704														

11.5 Questionnaire 1: Factor Analysis output (11 factors)

	Component										
	1	2	3	4	5	6	7	8	9	10	11
Q1_TIPI										.733	
Q2_NEUR			.712								
Q5_NEUR			.581								
Q8_NEUR			.665								
Q9_TIPI			-.365								-.643
Q12_NEUR			.712								
Q18_NEUR			.673								
Q41_PRIV		.850									
Q42_PRIV		.848									
Q43_TRU							.810				
Q44_PRIV		.787									
Q45_PRIV		.793									
Q46_PRIV		.831									
Q47_PRIV									.438		
Q48_TRU									.763		
Q49_PRIV				.596							
Q50_PRIV				.613							
Q51_PRIV				.765		-.362					
Q52_PRIV				.702							
Q53_PRIV				.657							
Q54_PRIV				.679							
Q55_TRU							.808				
Q56_PRIV				.727							
Q57_PRIV				.441							

Q58_TRU									.715		
Q59_PRIV				.553							
Q60_USE					.834						
Q61_USE					.855						
Q62_TRU							.740				
Q63_USE					.889						
Q64_USE					.740						
Q65_RISK		.414						.656			
Q66_TRU									.664		
Q67_RISK								.767			
Q68_RISK		.454						.678			
Q69_INT	.399					.564					
Q70_TASK	.803										
Q71_INT	.792										
Q72_TASK	.861										
Q73_INT						.763					
Q74_TASK	.817										
Q75_INT	.354					.613					
Q76_INT	.767										
Q77_TASK	.818										
Q78_INT						.796					
Q3TIPI_R										.733	
Q4_NEUR_R											.775
Q6_NEUR_R			.542								
Q7_NEUR_R			.578								
Q10_TIPI_R											
Q11_NEUR_R			.486		.369						
Q16_NEUR_R			.832								

11.6 Questionnaire 2

Investigating the use of Location-Based Services: UK

We are conducting this survey because we would like to find out your views on Location Based Services (LBS). Location Based Services can collect information about your geographical position using a mobile phone. This is done using signals between your phone and a cell phone tower or base station. This information can be held by the mobile phone networks (for example, O², Vodafone, and Orange). Collecting this information about your location is becoming quite common.

We think this area of research is important because:

- **Current users of LBS have reported clear advantages and disadvantages of such services**
- **If you were working away from your office, for example, your employer could locate where you were**
- **Location tracking devices are often put in place to help employees who work alone, outside, or in high risk areas**

Submit

Please fill in the consent form below before you proceed with the survey. The information you provide will be kept strictly private and confidential.

1 * I have read and understood the information presented

YES NO

2 * I have had an opportunity to ask questions (you can e-mail the principal investigator lisa.thomas@northumbria.ac.uk)

YES NO

3 * I understand I am free to withdraw from the study at any time, without having to give a reason for withdrawing, and without prejudice

YES NO

4 * I agree to take part in this study

YES NO

5 * Please identify your age group:

- 16-19
- 20-24
- 25-44
- 45-59
- 60 and above

6 * Are you:

- Male
- Female

7 * Please indicate where you live:

- Asia
- Africa
- North America
- South America
- Europe
- Australia

8 * Please identify your ethnic group:

- White (British)
- White (Other)
- Black/African American
- Chinese
- Indian
- Pakistani
- Bangladeshi
- Asian (Other)
- Caribbean
- African
- American Indian/Alaska Native
- Hawaiian
- Other, please specify

9 * Please identify your employment status:

- Full-time paid employment
- Part-time paid employment
- Self-employed
- Voluntary employment

10 Which employment sector do you work in?

- Accountancy/Banking/Business Services
- Advertising/Marketing/PR
- Charity Work
- Construction/Engineering/Agriculture
- Education
- Government/Public Sector
- Health/Social Care
- HR/IT/Legal Services
- Manufacturing
- Media/Publishing
- Tourism/Hospitality/Retail
- Transport/Logistics
- Other, please specify

Whether you use this LBS service at work or not, we wish to find out your views about it. There are no right or wrong answers. The following statements refer to your experiences **at work**.

Could you rate the extent to which these statements apply to you:

11 * It bothers me if my employer stores my location information

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

12 * It bothers me if my location information is available to my employer

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

13 * I'm concerned that my employer will collect too much location information about me

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

14 * I'm not comfortable with the idea that my employer is able to track me at any time

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

15 * I would rather not provide my location information to my employer

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

The following questions ask about feelings of **trust** towards your **employer**.

Could you rate the extent to which these statements apply to you:

16 * My employer is trustworthy

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

17 * I trust that my employer has my best interests in mind

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

18 * My employer is known as one that keeps promises and commitments

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

The following questions ask about feelings of **trust** towards an **LBS provider**.

Could you rate the extent to which these statements apply to you:

19 * The LBS provider would be trustworthy

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

20 * The LBS provider would keep promises and commitments

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

21 * I trust that the LBS provider would have my best interests in mind

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

We would now like to ask you about the acceptability of using Location Based Services in the workplace, and more specifically, when you think a tracking system would be **useful**.

Could you rate the extent to which these statements apply to you:

22 * Using LBS would improve my performance at work

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

23 * Using LBS at work would increase my productivity

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

24 * Using LBS would enhance my effectiveness at work

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

25 * I would find LBS useful at work

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

These statements relate to how likely you think you would use an LBS system, *if you had access to one*.

Could you rate the extent to which the below statements apply to you:

26 * I would use LBS if I was working alone

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

27 * I would use LBS if I was somewhere a great distance from my workplace

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

28 * I would use LBS if I was working in an unknown area

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

29 * I would use LBS if I was working in a dangerous area

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

30 * I would use LBS to be located during working hours

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

31 * I would use LBS to allow my employer to locate me during working hours

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

32 * Do you have a location-based services system in your workplace?

- Yes
- No
- Don't know

33 If you answered yes to the previous question, how often do you use the LBS system?

Not at all	Less than once per week	About once per week	2-3 times per week	4-6 times per week	About once a day	More than once a day
1	2	3	4	5	6	7

The following questions refer to your location information being accessed using **social networking sites**.

For example, Facebook announced 'Places' in 2010. It is a feature that lets users "check in" to Facebook using a mobile device to let a user's friends know where they are. Once you 'check in', your update will appear on your friends' news feeds and your Facebook wall. Similarly, Foursquare is a location-based social networking website. These services are available to users with GPS-enabled mobile devices, such as iPhones, Blackberrys and Android mobile phones.

The following questions ask about your feelings towards networking sites such as **Facebook Places** or **Foursquare**.

Could you rate the extent to which these statements apply to you:

34 * It bothers me if social networking sites store my location information

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

35 * It bothers me if my location information from a social networking site is available to my friends and family

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

36 * I'm concerned that social networking sites will collect too much location information about me

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

37 * I'm not comfortable with the idea that social networking sites are able to track me at any time

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

38 * I would rather not provide my location information to social networking sites

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

The following questions ask about feelings of **trust** using networking sites such as **Facebook Places** or **Foursquare**.

Could you rate the extent to which these statements apply to you:

39 * Social networking sites are trustworthy

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

40 * I trust that social networking sites have my best interests in mind

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

41 * Social networking sites are known to keep promises and commitments

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

We would now like to ask you who you think you would be happy **disclosing your location information** to.

Remember, with your *permission*, these sites can allow your location to be viewed by people you know.

Could you rate the extent to which these statements apply to you:

42 * I would use social networking sites to share my location information with friends

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

43 * I would use social networking sites to share my location information with family

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

44 * I would use social networking sites to share my location information with my employer

Strongly disagree	Disagree	Disagree somewhat	Neither agree/ disagree	Agree somewhat	Agree	Strongly agree
1	2	3	4	5	6	7

45 * Do you currently use a location-based application on a social networking site, such as Facebook Places or Foursquare?

Yes	No
1	2

46 If you answered yes to the previous question, how often do you use the system?

Not at all	Less than once per week	About once per week	2-3 times per week	4-6 times per week	About once a day	More than once a day
1	2	3	4	5	6	7

Thank you for completing this survey

47 Do you wish to tell us about anything else you think is important about LBS, or have any other comments?

This survey aims to discover what factors predict intentions to use LBS in the workplace. This research is being conducted at Northumbria University, UK, as part of a three year ESRC funded PhD research project, carried out by Lisa Thomas and led by Professor Pam Briggs and Dr Linda Little.

If you have any questions about this survey, please e-mail the researcher: **lisa.thomas@northumbria.ac.uk**

If you would like to receive feedback on the *overall* results of the study, please e-mail the researcher. This information will not be available until 1st June 2011.

11.7 Questionnaire 2: Factor Analysis output

Rotated Component Matrix[a]

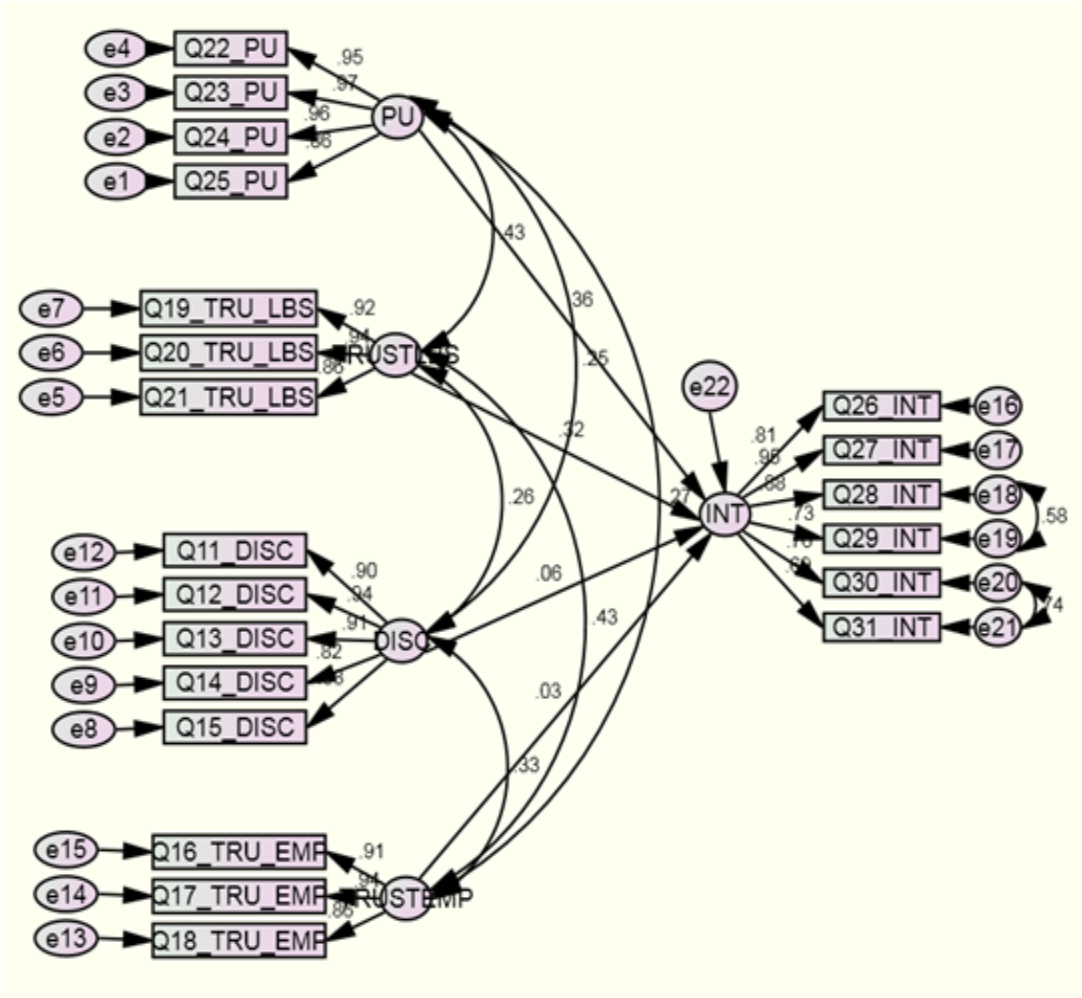
	Component				
	1	2	3	4	5
Q11_DISC	.898				
Q12_DISC	.927				
Q13_DISC	.914				
Q14_DISC	.851				
Q15_DISC	.881				
Q16_TRU_EMP				.914	
Q17_TRU_EMP				.891	
Q18_TRU_EMP				.894	
Q19_TRU_LBS					.875
Q20_TRU_LBS					.890
Q21_TRU_LBS					.834
Q22_PU			.915		
Q23_PU			.926		
Q24_PU			.923		
Q25_PU			.824		
Q26_INT		.741			
Q27_INT		.850			
Q28_INT		.912			
Q29_INT		.880			
Q30_INT		.723	.352		
Q31_INT		.645			

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

11.8 Questionnaire 2: AMOS Model Fit Summary



Chi-square = 1003.955

Degrees of freedom = 177

Probability level = .000

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	54	1003.955	177	.000	5.672
Saturated model	231	.000	0		
Independence model	21	22593.927	210	.000	107.590

Model	RMR	GFI	AGFI	PGFI
Default model	.189	.910	.883	.698
Saturated model	.000	1.000		
Independence model	1.052	.212	.134	.193

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.956	.947	.963	.956	.963
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Model	NCP	LO 90	HI 90
Default model	826.955	731.129	930.273
Saturated model	.000	.000	.000
Independence model	22383.927	21893.746	22880.404

Model	FMIN	F0	LO 90	HI 90
Default model	1.027	.846	.748	.951
Saturated model	.000	.000	.000	.000
Independence model	23.102	22.887	22.386	23.395

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.069	.065	.073	.000
Independence model	.330	.326	.334	.000

Model	AIC	BCC	BIC	CAIC
Default model	1111.955	1114.440	1375.827	1429.827
Saturated model	462.000	472.632	1590.789	1821.789
Independence model	22635.927	22636.894	22738.544	22759.544

11.9 Questionnaire 2: SNS Factor Analysis output

Rotated Component Matrix[a]

	Component		
	1	2	3
Q34_SNS_DISC	.883		
Q35_SNS_DISC	.777		
Q36_SNS_DISC	.899		
Q37_SNS_DISC	.881		
Q38_SNS_DISC	.851		
Q39_SNS_TRU		.876	
Q40_SNS_TRU		.870	
Q41_SNS_TRU		.892	
Q42_SNS_INT_PERS			.828
Q43_SNS_INT_PERS			.894
Q44_SNS_INT_PERS		.378	.675

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

11.10 Disclosure study: concept elicitation response sheet

TITLE OF PROJECT: **Investigating Information Disclosure in Relation to Location**

Participant ID Number:

Principal Investigator: Lisa Thomas

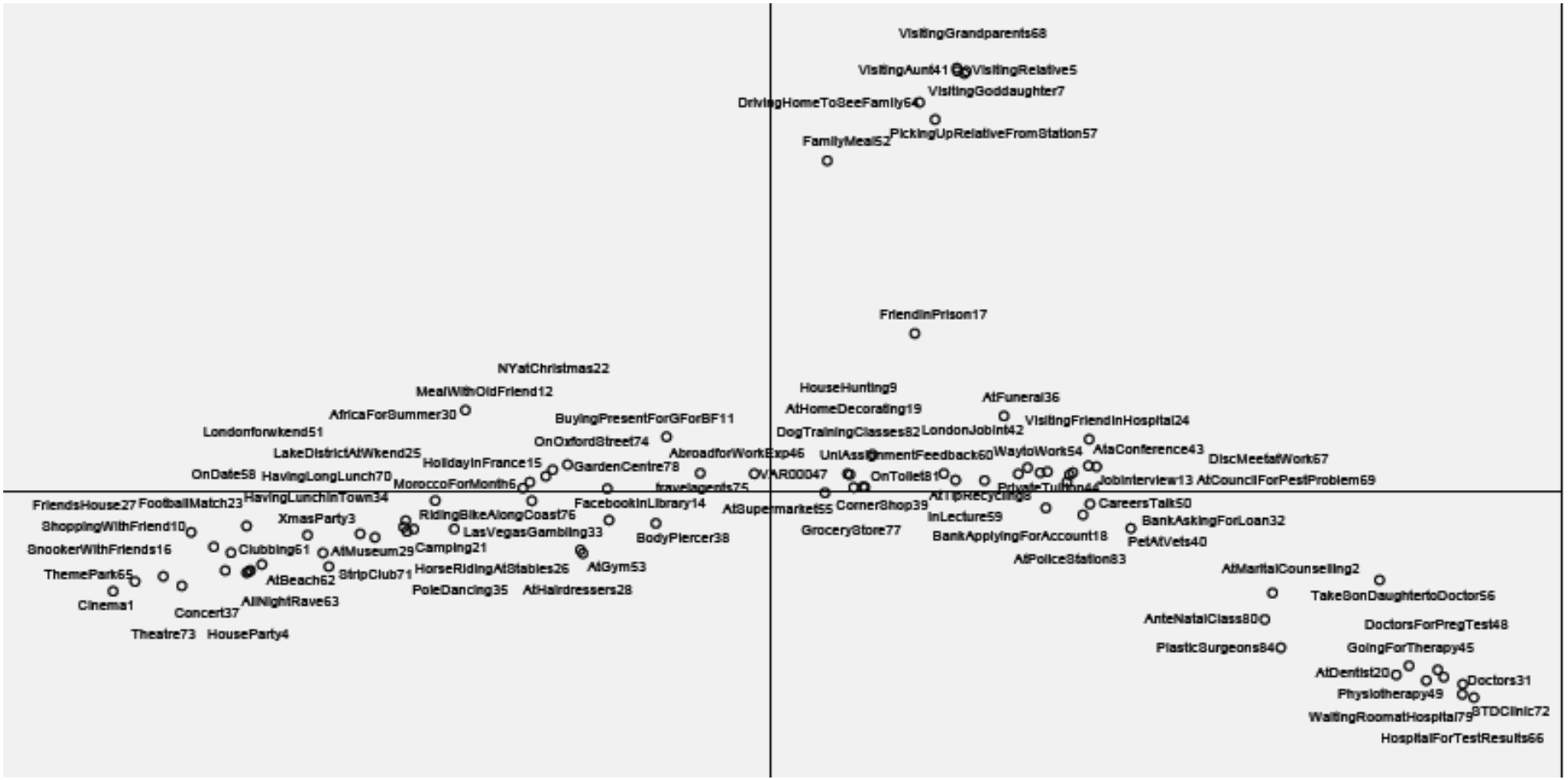
Investigator contact details: lisa.thomas@northumbria.ac.uk

Cards Picked	Information shared	Disclose? (Y/N)	Why?
e.g. Nurse	I was going to visit a friend in hospital	Y	
Mother		Y	
Lecturer		N	

11.11 Disclosure study: location types identified in phase 1

1. At the cinema
2. At marital counselling
3. At a Christmas party
4. At a house party
5. Visiting a relative
6. In Morocco for a month
7. Visiting my goddaughter
8. At tip doing my recycling
9. Out house-hunting
10. Shopping with a friend
11. Buying a birthday present for a girlfriend/boyfriend
12. Having a meal with an old friend
13. At a job interview
14. Looking at Facebook in the library
15. On holiday in France
16. Playing snooker with friends
17. Visiting a friend in prison
18. At bank applying for an account
19. At home doing decorating
20. At the dentist
21. Going camping
22. In New York at Christmas
23. Watching a football match
24. Visiting a friend in hospital
25. In the Lake District at the weekend
26. Riding my horse at the stables
27. At a friend's house
28. At the hairdressers
29. At a museum
30. Visiting Africa for the summer
31. At the doctors
32. At bank asking for a loan
33. In Las Vegas gambling in a casino
34. Having lunch in town
35. At a pole dancing lesson
36. At a funeral
37. At a gig/ concert
38. Visiting a body piercer
39. Going to the corner shop
40. Taking my pet to the vet
41. Visiting my Aunt
42. In London for a job interview
43. Attending a conference
44. Having some private tuition
45. Going to receive therapy
46. Staying abroad for work experience
47. At disciplinary meeting about work
48. At the doctors for a pregnancy test
49. At a physiotherapy appointment
50. At a careers talk
51. In London for weekend with friends
52. Having a family meal
53. At the gym
54. On my way to work
55. At the supermarket
56. Taking son/daughter to the doctor
57. Picking up a relative from the train station
58. On a date
59. In a lecture
60. Collecting university assignment feedback
61. Out clubbing
62. At the beach for the day
63. At an all night rave
64. Driving home to see family
65. At a theme park
66. At hospital getting test results
67. At a plastic surgeons
68. Visiting Grandparents
69. Visiting the council about a pest problem
70. Having a long lunch
71. In a strip club
72. At an STD clinic
73. At the theatre
74. On Oxford Street
75. At travel agents booking a holiday
76. Riding my bike at the coast
77. At the grocery store
78. Visiting the garden centre
79. Sitting in a waiting room at hospital
80. At an ante-natal class
81. On the toilet
82. At dog training classes
83. Going to the police station

11.12 Disclosure study: Multidimensional Scaling output



11.13 Lone-worker case study: interview schedule

Introduction

Briefly mention my research and why I wanted to interview them…
Could you just quickly tell me what you were asked to do in the study? E.g. time, instructions.
Could I also ask why you took part in the study?

LBS – refresh & explanation

This interview will focus on your experience using the PeopleSafe locating device.
Would you be able to tell me what device you used in the trial, and what you know about how it works?
What type of information can be monitored?
Can you think of other uses?

Your use of PeopleSafe

How useful did you think the device would be before the trial?
What did you think about actually using the system?
What aspects of your job mean that you would find it useful?
In general, in what circumstances do you think it would be useful?
Are there times in your job you wouldn't want your employer to know where you were?
Did you encounter any problems?
What changes to the system could make it easier or more convenient to use?

Perceived Privacy

How do you feel knowing that your location details could be obtained by your employer?
How concerned are you about your privacy (generally)?
How concerned are you about service providers (outside companies) having knowledge of your location?

Trust

Who would you like to run the service, if LBS tracking was widely implemented?
Do you feel your employer could manage the information about staff whereabouts?
Can you think of any personal issues associated with using the system?
Do you think this system would be acceptable to anyone?
Do you think it would suit some people more than others?

Future Use

How would you feel if the device was implemented in your workplace?
Would you make any changes?

11.14 Older adult case study: letter to participants

North East Age Research

Dear

I am writing to ask for your help with some research we are conducting at Northumbria University. You may remember that you took part in the New Dynamics of Ageing research (the study looking at mobility) approximately a year ago with North East Age Research. You kindly agreed to be contacted again if there were any further studies you could assist with.

My colleague, Lisa Thomas, is currently researching the use of tracking systems with a wide variety of people, and would greatly appreciate the opportunity to talk with you about your experience of using the tracking system here at Northumbria University.

Lisa is a PhD student in the School of Psychology & Sports Sciences. She is investigating the adoption of Location-Based Services (tracking systems) in real world settings. Lisa would like to hear about your attitudes towards location-based services, and hear about your experiences of the trial you took part in.

Lisa would like to interview you in person, and will telephone you in the next few days to speak to you and ask if you would like to take part. Her project has received full ethical approval from the School of Psychology & Sports Sciences Ethics Board.

If you have any questions or would like to discuss the research further please contact Lisa on [redacted].

Yours sincerely

Dr Lynn McInnes

11.15 Older adult case study: interview schedule

I am currently completing a PhD at Northumbria, and I am interested in people's attitudes to tracking technology. One example of this kind of technology is the New Dynamics of Ageing mobility trial you volunteered to take part in at Northumbria University. This is a **follow up study** investigating location tracking...

I would like to show you some examples of the information that can be collected using this technology

As you can see, there is a map of a route taken by one person during one day. Each marker on the map is a record of their location at that time. The bottom of the screen displays

- **the date they were travelling**
- **The addresses visited**
- **coordinates of their location**
- **their speed**

- Who would you be happy to share that information with, and why?
- Is there anybody you would be *unhappy* to share that information with, and why?
- Can you think of specific *location* information you'd be unhappy sharing? Eg. Places you would go to.
- Thinking about this map, how would you feel about family/friends/work colleagues/the emergency services seeing this?
- What if this was available to people ALL THE TIME?
- How would you feel if a stranger could access this?
- Would you prefer a different way to be tracked, or for the information to be displayed?
- If you could use this technology now, who would YOU give access to that information?
- Do you think different times of day/year/contexts when you would be happier sharing this information?

- Do you think this kind of monitoring could be dangerous or risky?
- Would you like to *control* this type of information, and who sees it?
- Do you think this technology could be used with anyone?

So this type of information collection is similar to the research about mobility, where you were asked to carry a pack with you to monitor your movement.

- Did you enjoy taking part?
- How useful did you think the pack would be before the trial?
- How useful did you think the experience was after the trial had finished?
- Could it have been made any easier/more convenient to use?
- Do you remember any problems?

So in general....

- Did you think this technology is relevant to you?
- Can you think of any other uses for the pack?

11.16 Family case study: interview schedule

Introduction

- I am *researching people's attitudes* regarding tracking-services. I am trying to find out what influences people to use this kind of system. I'm not necessarily an authority on ADHD or Aspergers.
- I will need you to sign the *consent forms*, and I provide you with ways of contacting me after the interview if you wish to.
- All data recorded will be *anonymised* when written up. No real names will be used, and once the recording has been transcribed it will be erased.
- I have studied *psychology* at undergraduate and postgraduate level, and am now interested in the effect technology has on our everyday lives.
- I would like to *ask permission to tape* record the interview, so I won't miss anything. I will be the only one with access to this recording, and it will be erased after transcription.

Background

- So tell me about how you came to use the system... when you first used it...
- What was going on in your lives at that point?

Usage

- Who uses the GPS system? The whole family?
- How often do you use the system?
- Tell me about how you learned to use the system within your family...
- Could you tell me about a typical day in your family?
- How does it affect your daily lives?

Attitudes

- Pros and cons of the system?
- How could it be better for you, if possible?
- Have your feelings towards this kind of technology changed over time?

Future

- Do you see yourselves using the system in the future?
- Would you change the system in any way?

Close

- After your experience of this system, what would you say to somebody who is reluctant to use GPS?
- Is there anything else you think I should know about, to understand your circumstances better?
- Is there anything you would like to ask me?

REFERENCES

Ackerman, M., Cranor, L., & Reagle, J. (1999). *Privacy in E-Commerce: Examining User Scenarios and Privacy Preferences.* Paper presented at the Proceedings of the 1st ACM conference on Electronic commerce.

Acquisti, A., & Gross, R. (2006). Imagined Communities: Awareness, Information Sharing, and Privacy on the Facebook. *Privacy Enhancing Technologies* (Vol. 4258, pp. 36-58): Springer Berlin / Heidelberg.

Adams, A. (2000). Multimedia information changes the whole privacy ballgame. *Proceedings of Computers, Freedom, and Privacy.*, 25-32.

Ajzen, I., & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs: Prentice-Hall.

Altman, I. (1975). *The Environment and Social Behavior : Privacy, Personal Space, Territory, Crowding.*: Brooks/Cole Pub. Co.

Alzheimer's Research UK. (2011). What is dementia? Retrieved 07.06.11, from http://www.alzheimersresearchuk.org/what-is-dementia/

Anthony, D., Kotz, D., & Henderson, T. (2009). Privacy in Location- Aware Computing Environments. *IEEE Pervasive, 6*(4), 64-72.

Arning, K., & Ziefle, M. (2007). Understanding age differences in PDA acceptance and performance. *Computers in Human Behavior, 23*(6), 2904-2927.

Bagüés, S. A., Zeidler, A., Valdivielso, C. F., & Matias, I. R. (2007). *Disappearing for a while - using white lies in pervasive computing*. Paper presented at the Proceedings of the 2007 ACM workshop on Privacy in electronic society.

Barak, A., & Gluck-Ofri, O. (2007). Degree and Reciprocity of Self-Disclosure in Online Forums. *CyberPsychology & Behavior, 10*, 407-417.

Barkhuus, L., & Dey, A. (2003). Location-Based Services for Mobile Telephony: A Study of Users' Privacy Concerns. *In Proceedings of Interact, 9th International Conference on Human-Computer Interaction*, p709-712.

Barnard, A. (2009). Growing Presence in the Courtroom: Cellphone Data as Witness. *New York Times*. Retrieved from http://www.nytimes.com/2009/07/06/nyregion/06cellphone.html

BBC. (2001). Life of Crime - Electronic tagging. Part 2. Retrieved 20th January, 2009, from http://news.bbc.co.uk/hi/english/static/in_depth/uk/2001/life_of_crime/e_tagging.stm

BBC News. (2010). Mobile that allows bosses to snoop on staff developed. Retrieved 24.8.11, from http://news.bbc.co.uk/1/hi/8559683.stm

Bellavista, P., Kupper, A., & Helal, S. (2008). Location-Based Services: Back to the Future. *Pervasive Computing, IEEE, 7*(2), 85-89.

Benisch, M., Kelley, P. G., Sadeh, N., & Cranor, L. F. (2010). Capturing Location-Privacy Preferences: Quantifying Accuracy and User-Burden Tradeoffs. *Personal and Ubiquitous Computing*. doi:10.1007/s00779-010-0346-0

Berendt, B., Günther, O., & Spiekermann, S. (2005). Privacy in E-commerce: Stated Preferences vs. Actual Behavior. *Communications of the ACM, 48*(4), 101-106.

Beresford, A., & Stajano, F. (2003). Location Privacy in Pervasive Computing. *IEEE Pervasive Computing, 2*(1), 46-55.

Bettini, C., Jajodia, S., Samarati, P., & Wang, S. (2009). *Privacy in Location-Based Applications: Research Issues and Emerging Trends*: Springer.

Boesen, J., Rode, J. A., & Mancini, C. (2010). *The domestic panopticon: location tracking in families*. Paper presented at the 12th ACM International Conference on Ubiquitous Computing. Retrieved from http://oro.open.ac.uk/23873/

Borgatti, S. (2007). Multidimensional Scaling. Retrieved 20.6.11, from http://www.analytictech.com/borgatti/mds.htm

Buddi. (2007). Retrieved 01.07.2011, from http://www.buddi.co.uk/

Carmien, S., Dawe, M., Fischer, G., Gorman, A., Kintsch, A., & Sullivan, J., J. (2005). Socio-technical environments supporting people with cognitive disabilities using public transportation. *ACM Trans. Comput.-Hum. Interact., 12*(2), 233-262.

Chang, S., Hsieh, Y., Lee, T., Liao, C., & Wang, S. (2007). *A User Study on the Adoption of Location Based Services.*, Heidelberg, Germany.

Charny, B. (2004). Big boss is watching. *CNET News.* Retrieved 1.8.11, from http://news.cnet.com/Big-boss-is-watching/2100-1036_3-5379953.html

Chen, L., Gillenson, M. L., & Sherrell, D. L. (2002). Enticing online consumers: an extended technology acceptance perspective. *Information & Management, 39*(8), 705-719.

Clark, C., & Dugdale, G. (2009). *Attitudes, behaviour and the role of technology*: National Literacy Trust.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences.* (2nd ed.). New York: Academic Press.

Coleman, G. W., Gibson, L., Hanson, V. L., Bobrowicz, A., & McKay, A. (2010). *Engaging the disengaged: how do we design technology for digitally excluded older adults?* Paper presented at the Proceedings of the 8th ACM Conference on Designing Interactive Systems.

Connelly, K., Khalil, A., & Liu, Y. (2009). Do I Do What I Say?: Observed Versus Stated Privacy Preferences. *Human-Computer Interaction – INTERACT 2007* (pp. 620-623).

Consolvo, S., Smith, I., Matthews, T., LaMarca, A., Tabert, J., & Powledge, P. (2005). *Location Disclosure to Social Relations: Why, When, and What People Want to Share.* Paper presented at the Proceedings of the SIGCHI conference on Human Factors in Computing Systems.

Coyle, D., & Doherty, G. (2009). *Clinical evaluations and collaborative design: developing new technologies for mental healthcare interventions*. Paper presented at the Proceedings of the 27th international conference on Human factors in computing systems.

Cranor, L. F., Reagle, J., & Ackerman, M. (1999). *Beyond Concern: Understanding Net Users' Attitudes About Online Privacy* (AT&T Labs-Research Technical Report).

Cvrcek, D., Kumpost, M., Matyas, V., & Danezis, G. (2006). *A study on the value of location privacy*. Paper presented at the Proceedings of the 5th ACM workshop on Privacy in electronic society.

Davis, F. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. [Article]. *MIS Quarterly, 13*(3), 319-340.

Davis, F., Bagozzi, R., & Warshaw, P. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science, 35*(8), 982-1003.

Dawe, M. (2006). *Desperately seeking simplicity: how young adults with cognitive disabilities and their families adopt assistive technologies*. Paper presented at the Proceedings of the SIGCHI conference on Human Factors in computing systems.

Dawes, J. (2008). Do Data Characteristics Change According to the Number of Scale Points Used? *International Journal of Market Research, 50*(1), 61-77.

Devitt, K., & Roker, D. (2009). The Role of Mobile Phones in Family Communication. *Children & Society, 23*(3), 189-202.

Dishion, T. J., & McMahon, R. J. (1998). Parental Monitoring and the Prevention of Child and Adolescent Problem Behavior: A Conceptual and Empirical Formulation. *Clinical Child and Family Psychology Review, 1*(1), 61-75.

Doro. (2011). Retrieved 23.5.11, from http://www.doro.co.uk/

Dourish, P., & Anderson, K. (2006). Collective information practice: emploring privacy and security as social and cultural phenomena. *Human-Computer Interaction, 21*(3), 319-342.

DSM-IV. (1994). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.). Washington DC, USA.: American Psychiatric Association.

Duckham, M., & Kulik, L. (2005). A Formal Model of Obfuscation and Negotiation for Location Privacy *Pervasive Computing* (pp. 152-170).

Dwyer, C., Hiltz, S., & Passerini, K. (2007). *Trust and privacy concern within social networking sites: A comparison of Facebook and MySpace.* Paper presented at the Americas Conference on Information Systems.

Dwyer, J. (2010). Four Nerds and a Cry to Arms Against Facebook. *The New York Times*. Retrieved from http://www.nytimes.com/2010/05/12/nyregion/12about.html?partner=rss&emc=rss

Essén, A. (2008). The two facets of electronic care surveillance: An exploration of the views of older people who live with monitoring devices. *Social Science & Medicine, 67*(1), 128-136.

Eysenck, H. J., & Eysenck, S. B. G. (1991). *Manual of the Eysenck Personality Scales (EPS Adult).* London: Hodder.

Fenech, T. (1998). Using perceived ease of use and perceived usefulness to predict acceptance of the World Wide Web. *Computer Networks and ISDN Systems, 30*(1-7), 629-630.

Finch, C. (2010). Employee Location Tracking = Big Brother? *Inc.* Retrieved 14.8.11, from http://www.inc.com/tech-blog/employee-location-tracking-big-brother.html

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*: MA: Addison-Wesley.

Fransella, F., Bannister, D., & Bell, R. (2003). *A Manual for Repertory Grid Technique.* (2nd ed.): Wiley-Blackwell.

Gefen, D., & Straub, D. W. (1997). Gender differences in the perception and use of E-mail: an extension to the technology acceptance model. *MIS Q., 21*(4), 389-400.

Ghinita, G. (2008). *Understanding the Privacy-Efficiency Trade-Off in Location Based Queries.* Paper presented at the Proceedings of the SIGSPATIAL ACM GIS 2008 International Workshop on Security and Privacy in GIS and LBS.

Giusti, L., Mencarini, E., & Zancanaro, M. (2010). *"Luckily, I don't need it": Elderly and the Use of Artifacts for Time Management*. Paper presented at the NordiCHI - The 6° Nordic Conference on Human-Computer Interaction.

Gosling, S., Rentfrow, P., & Swann, W. (2003). A Very Brief Measure of The Big-Five Personality Domains. *Journal of Research in Personality, 37*(6), 504-528.

Gransnet. (2011). Retrieved 13.05.2011, from http://www.gransnet.com/

Gross, R., & Acquisti, A. (2005). *Information revelation and privacy in online social networks*. Paper presented at the Proceedings of the 2005 ACM workshop on Privacy in the electronic society.

Guha, S., Tang, K., & Francis, P. (2008). *NOYB: privacy in online social networks*. Paper presented at the Proceedings of the first workshop on Online social networks.

Gunaratne, J. A., & Brush, A. J. B. (2010). *Newport: enabling sharing during mobile calls*. Paper presented at the Proceedings of the 28th international conference on Human factors in computing systems.

Harper, R. H. R. (1993). *Why Do People Wear Active Badges?* : Rank Xerox Research Centre.

Harrison, B., & Dey, A. (2009). What Have You Done with Location-Based Services Lately? *Pervasive Computing, IEEE, 8*(4), 66-70.

Harrison, D. (2008). Government's record year of data loss. *The Telegraph*. Retrieved from http://www.telegraph.co.uk/news/politics/1574687/Governments-record-year-of-data-loss.html

Hazas, M., Scott, J., & Krumm, J. (2004). Location-aware computing comes of age. *Computer, 37*(2), 95-97.

Hightower, J., LaMarca, A., & Smith, I. (2006). Practical Lessons from Place Lab. *Pervasive Computing, IEEE, 5*(3), 32-39.

Hirsch, T., Forlizzi, J., Hyder, E., Goetz, J., Kurtz, C., & Stroback, J. (2000). *The ELDer project: social, emotional, and environmental factors in the design of eldercare technologies*. Paper presented at the Proceedings on the 2000 conference on Universal Usability.

Hong, J., Ng, J., Lederer, S., & Landay, J. (2004). *Privacy Risk Models For Designing Privacy-Sensitive Ubiquitous Computing Systems.* Paper presented at the Proceedings of The 5th Conference On Designing Interactive Systems: Processes, Practices, Methods, And Techniques, New York, United States.

Hudson, S., & Smith, I. (1996). *Techniques for addressing fundamental privacy and disruption tradeoffs in awareness support systems*. Paper presented at the

Proceedings of the 1996 ACM conference on Computer supported cooperative work.

Iachello, G., & Hong, J. (2007). End-User Privacy in Human-Computer Interaction. *Foundations and Trends in Human-Computer Interaction., 1*(1), 1-137.

Iachello, G., Smith, I., Consolvo, S., Abowd, G., Hughes, J., Howard, J., et al. (2005). Control, Deception, and Communication: Evaluating the Deployment of a Location-Enhanced Messaging Service. *UbiComp 2005: Ubiquitous Computing* (pp. 213-231).

Ignatova, E., & Brinkman, W. (2007). *Clever tracking user behaviour over the web: enabling researchers to respect the user.* Paper presented at the Proceedings of the 21st British HCI Group Annual Conference on HCI 2008: People and Computers XXI: HCI...but not as we know it - Volume 2.

IPIP. (2009). A Scientific Collaboratory for the Development of Advanced Measures of Personality Traits and Other Individual Differences. Retrieved 16.06.2009: http://ipip.ori.org/newNEODomainsKey.htm

Jedrzejczyk, L., Price, B. A., Bandara, A. K., & Nuseibeh, B. (2009). *I Know What You Did Last Summer: risks of location data leakage in mobile and social computing* (No. 2009/11): The Open University.

Jensen, C., & Potts, C. (2004). *Privacy policies as decision-making tools: an evaluation of online privacy notices*. Paper presented at the CHI 2004 conference.

Jiang, B., & Zipf, A. (2006). How do location-based services hit Google? *Computers, Environment and Urban Systems, 30*(6), 709-711.

Joinson, A. (2001). Self-disclosure in computer-mediated communication: The role of self-awareness and visual anonymity. *European Journal of Social Psychology, 31*(2), 177-192.

Joinson, A. (2008). *Looking at, looking up or keeping up with people? Motives and use of facebook*. Paper presented at the Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems.

Joinson, A., Paine, C., Buchanan, T., & Reips, U. (2008). Measuring self-disclosure online: Blurring and non-response to sensitive items in web-based surveys. *Computers in Human Behavior, 24*(5), 2158-2171.

Joinson, A., Paine, C., Reips, U.-D., & Buchanan, T. (2006). *Privacy and Trust: The role of situational and dispositional variables in online disclosure.* Paper presented at the Workshop proceedings of Pervasive 2006, Dublin.

Jonietz, E. (2004). Tracking Privacy. *Technology Review,* (Radio frequency identification (RFID) and privacy),

Junglas, I. (2007). On The Usefulness And Ease of Use of Location-Based Services: Insights Into The Information System Innovator's Dilemma. *International Journal of Mobile Communications, 5*(4), 389-408.

Junglas, I., Johnson, N., & Spitzmüller, C. (2008). Personality Traits and Privacy Perceptions: an Empirical Study in the Context of Location-Based Services. *European Journal of Information Systems, 17*(4), 387-402.

Junglas, I., & Spitzmüller, C. (2005). *A Research Model For Studying Privacy Concerns Pertaining To Location-Based Services.* Paper presented at the Proceedings of the Annual Hawaii International Conference on System Sciences, United States.

Junglas, I., & Watson, R. (2008). Location-Based Services: Perceptions of Location-Tracking and Location-Awareness Services. [Article]. *Communications of the ACM, 51*(3), 65-69.

Kaasinen, E. (2003). User needs for location-aware mobile services. *Personal and Ubiquitous Computing, 7*(1), 70-79.

Kaiser, H. (1974). An index of factorial simplicity. *Psychometrika, 39*(1), 31-36.

Karat, C., Karat, J., & Brodie, C. (2007). Management of Personal Information Disclosure: The Interdependence of Privacy, Security, and Trust. In W. Jones & J. Teevan (Eds.), *Personal Information Management: Challenges and Opportunities* (pp. 249 - 260): University of Washington Press.

Kewley, G., D. (1999). *Attention deficit hyperactivity disorder: Recognition, reality and resolution.*: London: David Fulton Publishers.

Khalil, A., & Connelly, K. (2006). *Context-Aware Telephony: Privacy Preferences and Sharing Patterns.*, New York, United States.

Kim, S. (2008). Moderating Effects of Job Relevance and Experience on Mobile Wireless Technology Acceptance: Adoption of A Smartphone By Individuals. *Information & Management, 45*(6), 387-393.

Kline, R. (2005). *Principles and Practice of Structural Equation Modeling*: New York ; London : Guilford.

Kruskal, J., & Wish, M. (1977). *Multidimensional Scaling*. Beverly Hills. CA.: Sage Publications.

Landau, R., Auslander, G., Werner, S., Shoval, N., & Heinik, J. (2010a). Families' and professional caregivers' views of using advanced technology to track people with dementia. *Qualitative Health Research, 20*(3), 409-419.

Landau, R., Auslander, G., Werner, S., Shoval, N., & Heinik, J. (2010b). Who should make the decision on the use of GPS for people with dementia? *Aging & Mental Health, 15*(1), 78 - 84.

Landau, R., Werner, S., Auslander, G., Shoval, N., & Heinik, J. (2010). What do cognitively intact older people think about the use of electronic tracking devices for people with dementia? A preliminary analysis. *International Psychogeriatrics, 22*(8), 1-9.

Lauder, M. (1993). *Locus of Control and Stress: An Investigation into the Relationship Between Perceptions of Controllability of Events and Levels of Reported Stress. In 'BPS Manual of Psychology Practicals: Experiment, Observation and Correlation'. (McIlvern, R., Higgins, L., Wadeley, A., Humphreys, P.)*: Wiley-Blackwell.

Lawson, S. (2002). AT&T Wireless Helps Callers Find Friends. Retrieved 13 November 2008, from http://www.pcworld.com/article/102269/atandt_wireless_helps_callers_find_friends.html

Lederer, S., Dey, A. K., & Mankoff, J. (2003). *A conceptual model and a metaphor of everyday privacy in ubiquitous computing environments.* University of California, Berkeley, CA.

Lederer, S., Mankoff, J., & Dey, A. (2003). *Who Wants to Know What When? Privacy Preference Determinants in Ubiquitous Computing.* Paper presented at the CHI '03. Extended abstracts on Human factors in Computing Systems.

Lederer, S., Mankoff, J., Dey, A., & Beckmann, C. (2003). *Managing personal information disclosure in ubiquitous computing environments.* (Technical report CSD-03-1257): University of California, Berkeley, California.

Lee, S., & Kleiner, B. (2003). Electronic surveillance in the workplace. *Management Research News, 26*(2/3/4), 72-81.

Lewis, K., Kaufman, J., & Christakis, N. (2008). The Taste for Privacy: An Analysis of College Student Privacy Settings in an Online Social Network. *Journal of Computer-Mediated Communication, 14*(1), 79-100.

Lianos, M. (2003). Social Control after Foucault. *Surveillance & Society, 1*(3), 412-430.

Liikanen, E. (2003). Commission recommendation of 25 July 2003. Processing of caller location information in electronic communication networks., from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:189:0049:0051:EN:PDF

Likert, R. (1932). A Technique for the Measurement of Attitudes. *Archives of Psychology, 140*, 5-55.

Little, L., & Briggs, P. (2008). *Ubiquitous healthcare: do we want it?* Paper presented at the Proceedings of the 22nd British HCI Group Annual

Conference on People and Computers: Culture, Creativity, Interaction - Volume 2.

Little, L., & Briggs, P. (2009). *Pervasive healthcare: the elderly perspective*. Paper presented at the Proceedings of the 2nd International Conference on PErvasive Technologies Related to Assistive Environments.

Little, L., Sillence, E., & Briggs, P. (2009). *Ubiquitous systems and the family: thoughts about the networked home*. Paper presented at the Proceedings of the 5th Symposium on Usable Privacy and Security.

Lofland, J., Snow, D., Anderson, L., & Lofland, L. (2006). *Analyzing Social Settings: A Guide to Qualitative Observation and Analysis* (4th ed.): Wadsworth, Canada.

LoJack. (2011). 'SafetyNet by LoJack'. Retrieved 20/05/2011, from http://www.lojack.com/safetynet/Pages/index.aspx

Luarn, P., & Lin, H.-H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in Human Behavior, 21*(6), 873-891.

Malhotra, N., & Birks, D. (2006). *Marketing Research. An Applied Approach.* (2nd ed.): Prentice Hall.

Malhotra, N., Sung, S., & Agarwal, J. (2004). Internet Users' Information Privacy Concerns (IUIPC): The Construct, the Scale, and a Causal Model. *Information Systems Research, 15*(4), 336-355.

Marco, A., Casas, R., Falco, J., Gracia, H., Artigas, J., & Roy, A. (2008). Location-Based Services for Elderly and Disabled people. [Article]. *Computer Communications, 31*(6), 1055-1066.

Margulis, S. (2003). On the Status and Contribution of Westin's and Altman's Theories of Privacy. *Journal of Social Issues, 59*(2), 411-429.

Marias, G., Kazatzopoulos, L., Delakouridis, C., & Georgiadis, P. (2006). Applying Privacy on the Dissemination of Location Information. *Telematics and Informatics, 23*(3), 211-225.

Marmasse, N., & Schmandt, C. (2000). Location-Aware Information Delivery with ComMotion. *Handheld and Ubiquitous Computing* (Vol. 1927, pp. 361-370): Springer Berlin / Heidelberg.

Marmasse, N., & Schmandt, C. (2003). *Safe & Sound: a Wireless Leash*. Paper presented at the CHI '03 extended abstracts on Human factors in Computing Systems.

Marmasse, N., Schmandt, C., & Spectre, D. (2004). WatchMe: Communication and Awareness Between Members of a Closely-Knit Group. *UbiComp 2004: Ubiquitous Computing* (Vol. 3205, pp. 214-231): Springer Berlin / Heidelberg.

Mayer, R., Davis, J., & Schoorman, F. (1995). An Integrative Model of Organizational Trust. *Academy of Management Review, 20*(3), 709-734.

McCrae, R., & Costa, P. (1987). Validation of the Five-Factor Model of Personality Across Instruments and Observers. *Journal of Personality and Social Psychology, Vol. 52(1)*, 81-90.

McCreadie, C., & Tinker, A. (2005). The acceptability of assistive technology to older people. *Ageing and Society, 25*(1), 91-110.

McCullagh, D. (2011). How police have obtained iPhone, iPad tracking logs. *CNET News: Privacy INC* Retrieved 28.4.11, from http://news.cnet.com/8301-31921_3-20056344-281.html

Melander-Wikman, A., Fältholm, Y., & Gard, G. (2008). Safety vs. privacy: elderly persons' experiences of a mobile safety alarm. *Health & Social Care in the Community, 16*(4), 337-346.

Michael, K., McNamee, A., & Michael, M. (2006). *The Emerging Ethics of Humancentric GPS Tracking and Monitoring.* Paper presented at the Proceedings of the International Conference on Mobile Business, Copenhagen, Denmark.

Minch, R. (2004). *Privacy Issues in Location-Aware Mobile Devices*, Piscataway, United States.

Mishra, J., & Crampton, S. (1998). Employee monitoring: Privacy in the workplace? *SAM Advanced Management journal, 63*(3).

Miskelly, F. (2004). A novel system of electronic tagging in patients with dementia and wandering. *Age and Ageing 33*(3), 304-306.

Mobi.Stealth.com. (2011). Employee Monitoring Software for iPhone, BlackBerry and Android. Retrieved 15.8.11, from http://www.mobistealth.com/employee-monitoring-tracking-spy-software.php

Monmonier, M. (2006). Geolocation and Locational Privacy: The "Inside" Story on Geospatial Tracking. *Privacy and Technologies of Identity* (pp. 75-91): Springer US.

Moore, G., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research, 2*(3), 192-222.

Müller, C., Wan, L., & Hrg, D. (2010). *Dealing with wandering: a case study on caregivers' attitudes towards privacy and autonomy when reflecting the use of LBS*. Paper presented at the Proceedings of the 16th ACM international conference on Supporting group work.

NDA. (2011). Retrieved 4.5.11, from http://www.newdynamics.group.shef.ac.uk/

Olson, J., Grudin, J., & Horvitz, E. (2005). *A Study of Preferences for Sharing and Privacy.* Paper presented at the CHI '05 extended abstracts on Human factors in Computing Systems.

Orwell, G. (1949). *Nineteen Eighty-Four.*: Secker and Warburg (London).

Osman, Z., Maguire, M., & Tarkiainen, M. (2003). Older Users' Requirements for Location Based Services and Mobile Phones. *Human-Computer Interaction with Mobile Devices and Services, 2795*, 352-357.

Palen, L., & Dourish, P. (2003). *Unpacking "Privacy" for a Networked World.* Paper presented at the Proceedings of the SIGCHI conference on Human factors in Computing Systems.

Palen, L., & Hughes, A. (2007). When home base is not a place: parents' use of mobile telephones. *Personal Ubiquitous Computing, 11*(5), 339-348.

Papataxiarhis, V., Riga, V., Nomikos, V., Sekkas, O., Kolomvatsos, K., Tsetsos, V., et al. (2009). MNISIKLIS:Indoor Location Based Services for All *Location Based Services and TeleCartography II* (pp. 263-282): Springer Berlin Heidelberg.

Patil, S., & Lai, J. (2005). *Who Gets to Know What When: Configuring Privacy Permissions in an Awareness Application.*, New York, United States.

Pattison, M., & Stedmon, A. W. (2006). Inclusive Design and Human Factors: Designing Mobile Phones for Older Users. *Proceedings of PsychNology Journal*, 267-284.

Pavlou, P. (2001). Integrating Trust in Electronic Commerce with the Technology Acceptance Model: Model Development and Validation. *AMCIS 2001 Proceedings.*(Paper 159).

Pavlou, P. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce, 7*(3), 69-103.

Pavlou, P., & Gefen, D. (2004). Building Effective Online Marketplaces with Institution-Based Trust. *Information Systems Research, 15*(1), 37-59.

Pedersen, D. (1999). Model For Types Of Privacy By Privacy Functions. *Journal of Environmental Psychology, 19*(4), 397-405.

Peluchette, J., & Karl, K. (2008). Social networking profiles: an examination of student attitudes regarding use and appropriateness of content. *Cyberpsychology and Behaviour, 11*(1), 95-97.

Perusco, L., & Michael, K. (2007). Control, Trust, Privacy, and Security: Evaluating Location-Based Services. [Article]. *IEEE Technology and Society Magazine, 26*(1), 4-16.

Phelps, J., Nowak, G., & Ferrell, E. (2000). Privacy Concerns and Consumer Willingness to Provide Personal Information. *Journal of Public Policy & Marketing, 19*, 27-41.

Priyantha, N. (2005). *The Cricket Indoor Location System.* Massachusetts Institute of Technology.

Pura, M. (2005). Linking Perceived Value and Loyalty in Location-Based Mobile Services. *Managing Service Quality, 15*, 509-538.

Rabin, R. (2011, 4.7.11). What Cellphone Calls Say About Parent-Teenager Relations. *The New York Times*. Retrieved from http://well.blogs.nytimes.com/2011/07/01/what-cellphone-calls-say-about-parent-teenager-relations/

Rao, B., & Minakakis, L. (2003). Evolution of mobile location-based services. *Communications of the ACM - Mobile computing opportunities and challenges, 46,* 61-65.

Rashid, U., & Woo, W. (2006). *Personal Information Disclosure Management in Smart Home Tele health care*. Paper presented at the The 4th international symposium on ubiquitous VR.

Reardon, M. (2006). Mobile phones that track your buddies. Retrieved 28/1/10, from http://news.cnet.com/Mobile-phones-that-track-your-buddies---page-2/2100-1039_3-6135209-2.html?tag=mncol

Renaud, K., & Biljon, J. (2008). *Predicting technology acceptance and adoption by the elderly: a qualitative study*. Paper presented at the Proceedings of the 2008 annual research conference of the South African Institute of Computer Scientists and Information Technologists on IT research in developing countries: riding the wave of technology.

Roberts, L., & Wallop, H. (2010). Silver surfers increase by one million over the last year. *The Telegraph*. Retrieved from http://www.telegraph.co.uk/technology/internet/7862234/Silver-surfers-increase-by-one-million-over-the-last-year.html

Robson, C. (2002). *Real World Research : a Resource for Social Scientists and Practitioner-Researchers.* (2nd ed.): Oxford ; Madden, Mass. Blackwell Publishers.

Rodden, T., Friday, A., Muller, H., & Dix, A. (2002). A Lightweight Approach to Managing Privacy in Location-Based Services. *Proceedings of Equator Annual Conference*.

Romex. (2009). Monitoring Lone Workers helps you comply with Health & Safety. Retrieved 13/7/11, from http://www.romexworld.com/a/id/120/Monitoring-Lone-Workers-helps-you-comply-with-Health-&-Safety.html

Rotter, J. (1966). Generalized Expectancies for Internal Versus External Control of Reinforcement. *Psychological Monographs, 80*(1), 1-28.

Rowan, J., & Mynatt, E. D. (2005). *Digital Family Portrait Field Trial: Support for Aging in Place*. Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems.

Sadeh, N., Hong, J., Cranor, L., Fette, I., Kelley, P., Prabaker, M., et al. (2009). Understanding and capturing people's privacy policies in a mobile social networking application. *Personal and Ubiquitous Computing, 13*(6), 401-412.

Safe Trac. (2011). Retrieved 20.8.11, from http://www.safetrac-solutions.com/PersonalProtectionProducts.html

Schilit, B. N., LaMarca, A., Borriello, G., Griswold, W. G., McDonald, D., Lazowska, E., et al. (2003). *Challenge: ubiquitous location-aware computing and the "place lab" initiative*. Paper presented at the Proceedings of the 1st ACM international workshop on Wireless mobile applications and services on WLAN hotspots.

Schrammel, J., Koffel, C., & Tscheligi, M. (2009). *How much do you tell?: information disclosure behaviour indifferent types of online communities*. Paper presented at the Proceedings of the fourth international conference on Communities and technologies.

Sellen, A., Eardley, R., Izadi, S., & Harper, R. (2006). *The whereabouts clock: early testing of a situated awareness device*. Paper presented at the CHI '06 extended abstracts on Human factors in computing systems.

Selwyn, N. (2004). The information aged: A qualitative study of older adults' use of information and communications technology. *Journal of Aging Studies, 18*(4), 369-384.

Selwyn, N., Gorard, S., Furlong, J., & Madden, L. (2003). Older adults' use of information and communications technology in everyday life. *Ageing & Society, 23*(05), 561-582.

Shoval, N., Auslander, G., Cohen-Shalom, K., Isaacson, M., Landau, R., & Heinik, J. (2010). What can we learn about the mobility of the elderly in the GPS era? *Journal of Transport Geography, 18*(5), 603-612.

Sillence, E., Briggs, P., Harris, P., & Fishwick, L. (2007). How Do Patients Evaluate and Make Use of Online Health Information? [Article]. *Social Science & Medicine, 64*(9), 1853-1862.

Skeels, M. M., & Grudin, J. (2009). *When social networks cross boundaries: a case study of workplace use of facebook and linkedin*. Paper presented at the Proceedings of the ACM 2009 international conference on Supporting group work.

Smale, W. (2010). *Online dating soars as temperatures plunge.* Retrieved 16th March 2011, from http://news.bbc.co.uk/1/hi/8445593.stm

Smith, I., Consolvo, S., Lamarca, A., Hightower, J., Scott, J., Sohn, T., et al. (2005). Social Disclosure of Place: From Location Technology to Communication Practices. *Pervasive Computing*, 134-151. Retrieved from http://dx.doi.org/10.1007/11428572_9

Smith, J. (2007). *Qualitative Psychology. A Practical Guide to Research Methods.* London: Sage.

Smith, J., Milberg, S., & Burke, S. (1996). Information Privacy: Measuring Individuals' Concerns About Organizational Practices. *MIS Quarterly, 20*(2), 167-196.

Solo Protect. (2011). Retrieved 20.8.11, from http://www.connexion2.com/soloprotect-lone-worker-device-solutions.asp?gclid=COC-s-bZ2KoCFW4KtAod_QKB7g

Spitzmüller, C., & Stanton, J. (2006). Examining Employee Compliance with Organizational Surveillance and Monitoring. *Journal of Occupational and Organizational Psychology, 79*, 245-272.

Stattin, H., & Kerr, M. (2000). Parental Monitoring: A Reinterpretation. *Child Development, 71*, 1072-1085.

Stoddart, K. P. (1999). Adolescents with Asperger Syndrome: Three Case Studies of Individual and Family Therapy. *Autism, 3*(3), 255-271.

Stone, E., Gardner, D., Gueutal, H., & McClure, S. (1983). A Field Experiment Comparing Information-Privacy Values, Beliefs, and Attitudes Across Several Types of Organizations. *Journal of Applied Psychology, 68*(3), 459-468.

Stößel, C., & Blessing, L. (2010). *Mobile Device Interaction Gestures for Older Users*. Paper presented at the NordiCHI - The 6° Nordic Conference on Human-Computer Interaction.

Sullivan, M. (2010). Foursquare, Gowalla, and Facebook Places: Practical Uses for Location-Based Services. Retrieved 14.7.11, from http://www.pcworld.com/article/207978/foursquare_gowalla_and_facebook_places_practical_uses_for_locationbased_services.html#tk.mod_rel

Sweden.Se. (2011). Health Care in Sweden. Retrieved 25.5.11, from http://www.sweden.se/eng/Home/Society/Health-care/Facts/Health-care-in-Sweden/

Tagtronics. (2011). Retrieved 20.8.11, from http://www.tagtronics.co.uk/lone-worker-monitoring.php

TrackaPhone. (2011). Retrieved 2 February 2011, from http://www.trackaphone.eu/

Trochim, W. (1989). An introduction to concept mapping for planning and evaluation. *Evaluation and Program Planning, 12*(1), 1-16.

Trochim, W., & Kane, M. (2005). Concept mapping: an introduction to structured conceptualization in health care. *International Journal for Quality in Health Care, 17*(3), 187-191.

Tsai, J. Y., Kelley, P., Cranor, L. F., & Sadeh, N. (2009). Location-sharing technologies: Privacy risks and controls. *A Journal of Law and Policy for the Information Society*.

Tsai, J. Y., Kelley, P., Drielsma, P., Cranor, L. F., Hong, J., & Sadeh, N. (2009). *Who's viewed you? The impact of feedback in a mobile location-sharing application*. Paper presented at the Proceedings of the 27th international conference on Human factors in computing systems.

Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User Acceptance of Information Technology: Toward A Unified View. *MIS Quarterly, 27*(3), 425-478.

Vijavan, J., & Brewin, B. (2003). Wal-Mart to deploy radio ID tags for supply tracking. Retrieved 11 November 2008., from http://www.computerweekly.com/Articles/2003/06/13/195258/wal-mart-to-deploy-radio-id-tags-for-supply-tracking.htm

Vijayasarathy, L. R. (2004). Predicting consumer intentions to use on-line shopping: the case for an augmented technology acceptance model. *Information & Management, 41*(6), 747-762.

Vykoukalová, Z. (2007). Adolescent Mobile Communication: Transformation of Communication Patterns of Generation SMS? *Journal of Psychosocial Research on Cyberspace, 1*(1), Article 4.

Weisskirch, R. (2009). Parenting by Cell Phone: Parental Monitoring of Adolescents and Family Relations. *Journal of Youth and Adolescence, 38*(8), 1123-1139.

Westin, A. (1967). *Privacy and Freedom.* New York: Atheneum.

Wiehe, S., Carroll, A., Liu, G., Haberkorn, K., Hoch, S., Wilson, J., et al. (2008). Using GPS-enabled cell phones to track the travel patterns of adolescents. *International Journal of Health Geographics*.

Workman, M. (2009). A field study of corporate employee monitoring: Attitudes, absenteeism, and the moderating influences of procedural justice perceptions. *Inf. Organ., 19*(4), 218-232.

Xu, H., & Teo, H. (2004). *Alleviating Consumers' Privacy Concerns in Location-Based Services: A Psychological Control Perspective.* Paper presented at the Twenty-Fifth International Conference on Information Systems. Retrieved from http://aisel.aisnet.org/icis2004/64

Xu, H., Teo, H., & Tan, B. (2005, Dec. 2005). *Predicting the Adoption of Location-Based Services: The Roles of Trust and Privacy Risk.* Paper presented at the Proceedings of 26th Annual International Conference on Information Systems (ICIS 2005), Las Vegas, Nevada.

Zoomerang. (2011). Retrieved 17.5.11, from www.zoomerang.com

Zweig, D., & Webster, J. (2002). Where Is The Line Between Benign And Invasive? An Examination of Psychological Barriers to the Acceptance of Awareness Monitoring Systems. *Journal of Organizational Behavior, 23*(5), 605-633.